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Reconnaisance Investigation of the Geology of Yarrow and Doon Townships, District of Timiskaming, With Emphasis on the Huronian Supergroup

1989

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Reconnaisance Investigation of the Geology of Yarrow and Doon Townships, District of Timiskaming, With Emphasis on the Huronian Supergroup

by

R.M. Junnila

1989

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V.G. Milne

V.G. Milne, Director
Ontario Geological Survey

Foreword

Until 1987 the geology of Yarrow and Doon Townships was known only at a reconnaissance scale, and the area was believed to be underlain mainly by rocks of the Huronian Supergroup. As part of the Canada-Ontario Mineral Development Agreement (COMDA) signed by the governments of Canada and Ontario, the Yarrow and Doon Townships area was chosen for geological mapping by the Ontario Geological Survey.

This area contains several inliers of Archean metavolcanic and metasedimentary rocks in addition to the conglomerates and siltstones of the Proterozoic Gowganda Formation of the Huronian Supergroup. A lead-zinc mine was operated in Yarrow Township in the early 1950s and a barite mine is presently operating on Mistinikon Lake.

Two former gold producers are located just outside the map area and lithologies and structures favourable for gold exploration also occur in the present area and warrant further exploration.

V.G. Milne
Director
Ontario Geological Survey

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ABSTRACT

This report, based on a reconnaissance investigation, describes the geology of Yarrow and Doon Townships. The emphasis of the report is on rocks of the Huronian Supergroup found in these townships. The map area covers 187 km and is centred 11 km southwest of Matachewan in the District of Timiskaming.

The oldest rocks in the map area are Late Archean metavolcanic and metasedimentary rocks which are exposed in three small inliers. The metavolcanic rocks consist of massive, pillowed, and amygdaloidal mafic flows and massive intermediate to felsic flows, and tuffs. The metasedimentary rocks are banded chert-magnetite iron formation, diamictite, sandstone, and siltstone. These rocks are intruded by granodiorite and granite of the northwestern part of the Round Lake Batholith. The rocks are typically gneissic and in one zone contain mafic xenoliths derived from pre-existing mafic volcanic or mafic intrusive rocks, or both. All the above rock types have been intruded by north-trending Matachewan diabase dikes.

Early Proterozoic sedimentary rocks of the Huronian Supergroup rest unconformably on the Late Archean rocks. They underlie most of the map area and consist of the Lower Gowganda Formation (Coleman Member) of the Cobalt Group. Basal strata range from laminated mudstone-siltstone, and laminated mudstone with dropstones, to massive diamictite. The remainder of the succession, which is approximately 200 m-thick, consists of interbedded sandstone, diamictite, and minor siltstone; soft-sediment deformation is common. The rocks are composed of

glacial debris deposited subaqueously by debris flows, turbidites, and by ice-rafting. Deposition was controlled by a major ice-sheet situated over a continental margin during a glacial regime.

Nipissing Intrusive Rocks are represented by isolated outcrops of diabase which intrude the Gowganda Formation. The diabase has also been intruded along the Late Archean-Early Proterozoic unconformity.

A large part of the map area is mantled by Quaternary deposits of gravel and sand. Two parabolic sand dunes were observed on a sand plain in southwestern Doon Township.

The Archean metavolcanic and metasedimentary rocks, which are locally sheared, strike to the northeast and dip steeply to the southwest, except for the metavolcanic rocks in southern Doon Township which dip steeply northward. The felsic intrusive rocks of the Round Lake Batholith possess a northeast-trending, vertical gneissosity that dips steeply to the northwest. Xenolith-bearing zones in the Round Lake Batholith have been intensely deformed. Rocks of the Gowganda Formation strike to the northeast and dip gently to the southeast. Two major northeast-trending faults occur in the map area. Northeast- and northwest-trending joint sets are prominent in the Gowganda Formation. Local variations in strike and dip indicate post-depositional block faulting.

Gold prospecting activity has taken place in northern Yarrow Township, where a lead mine was also briefly in production. This area lies to the south of the probable western extension of the Kirkland Lake-Larder Lake fault zone. Barite is currently produced in western Yarrow Township.

Chemical analyses of the major rock types of the area are listed in an appendix.

RECONNAISANCE INVESTIGATION OF THE GEOLOGY OF YARROW AND DOON TOWNSHIPS, DISTRICT OF TIMISKAMING, WITH EMPHASIS ON THE HURONIAN SUPERGROUP

By

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by R.M. JUNNILA

INTRODUCTION

Location

The Yarrow and Doon Township map area covers 187 km^2 and is located 1 km southwest of Matachewan in the District of Timiskaming (Figure 1). The area is bounded by Latitudes 47° 50′ 30" N and 47° 50′ 40" N and by Longitudes 80° 39′ 35" W and 80° 55′ 00" W.

Access and Exposure

The Town of Matachewan is located approximately 60 km southwest of Kirkland Lake and is reached via Highway 66. Access to the map area is by a gravel road which branches southwest from Highway 566, 2 km west of Matachewan. This road passes to the west through northwestern Yarrow Township and central Doon Township and provides access to the site of the now defunct mill and open-pit mine of United Asbestos Limited in Midlothian Township.

In Yarrow Township, a frequently used logging road leads south from the central road. The logging road, maintained by the Mitchell Logging Company, branches at Zig-Zag Lake. The eastern branch provides access to the Montreal River (Sisseney

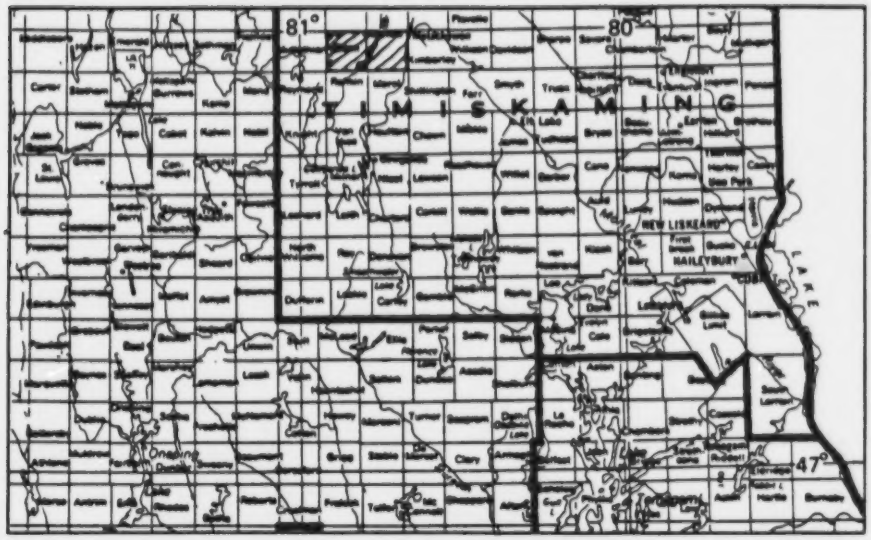

Figure 1: Key map showing location of the Yarrow-Doon map area.

Lake) via a side road south of Hildreth Lake in Morel Township. The western branch of the logging road provides access to southwestern Yarrow Township and runs parallel to the West Montreal River (Mistinikon Lake) well into Van Hise Township.

In Doon Township, a gravel road branches north from the central road and joins Highway 566 in northern Bannockburn Township. Another road immediately west of Elmer Lake leads south and crosses a cleared and reforested area. West of Duncan Creek a road traverses the cleared area and ends approximately 100 m north of Duncan Lake. During the field season this road was blocked by a dismantled bridge 700 m to the south of the central road. The creek at this location can be crossed with an all-terrain vehicle. Numerous tracks and trails branch from the roads in both townships

The metavolcanic and metasedimentary rocks, which possess little relief, are poorly exposed in Yarrow Township; in Doon Township they are exposed in the cleared area west of Duncan Creek. The felsic plutonic rocks in Yarrow Township are well-exposed, especially in numerous clearings and along roadside exposures. The lowermost strata of the Gowganda Formation are poorly exposed except in cleared areas and along roadcuts in central Doon Township. The remainder of the succession is well exposed in hills west of Sisseney Lake and east and west of Elmer Lake. Low water levels during the field season in 1987 enhanced shoreline exposures provided by the lakes and rivers of both townships.

Topography and Drainage

Topography in the map area is controlled by the nature of the geology. Areas underlain by Archean metavolcanic and metasedimentary rocks possess little relief. The base level in the area is 356 m above sea level. The Gowganda Formation forms hills and ridges with local relief of up to 200 m. The highest point in the map area is southwest of Elmer Lake, in Doon Township, where hills of the Gowganda Formation reach an elevation of 558 m above sea level. The gentle southeasterly dip of these strata forms a cuesta topography (Photo 1).

The height of land separating the watershed of the St. Lawrence River system from that of James Bay passes through Midlothian Township, immediately to the west of the map area. The West Montreal River flows northeastward through Doon and Yarrow Townships where it broadens to form Mistinikon Lake. At "the Great Northern Bend" in Baden Township the river is diverted southeastward away from the height of land. The Montreal River flows northeastward through Morel and Yarrow Townships where it forms Sisseney Lake. The confluence of the two streams is 1 km south of Matachewan (Matachewan is the anglicized form of the Ojibway word "Madagewin" which means "where the rivers meet"). From here, the Montreal River flows southeastward to Lake Timiskaming.

Most of Doon Township and parts of Yarrow Township are covered by gravel and are well-drained. The western part of Doon Township consists of a sand plain. Isolated swamps occur here along the flood plain of Duncan Creek, and around the margin of Kame Lake.

Previous Geological Investigations

The first mapping in the vicinity was by Bell (1876) who described the geology along the shore of the Montreal and the West Montreal Rivers. To the west, Burwash (1896) mapped along the Nipissing-Algoma survey line. The southern halves of Yarrow and Doon Townships were mapped on a broad reconnaissance scale by Collins (1913). In 1916, following the discovery of gold in Powell Township, Burrows (1918) mapped northern Yarrow Township on a reconnaissance scale. Cooke (1919) mapped the northern halves of Yarrow and Doon Townships and also described in detail the property of Matachewan Consolidated Mines which lies a short distance to the north of Yarrow Township.

Following renewed gold exploration activity, Dyer (1935) performed detailed mapping and studied mine sites and mineral occurrences in the Matachewan area. He also mapped townships to the northeast of Matachewan and attempted to relate the local geology to that of the Kirkland Lake area.

Present Geological Survey

The aim of this project was to examine previously unmapped areas of Yarrow and Doon Townships inferred to be underlain by rocks of the Huronian Supergroup. In addition, inliers of Archean metavolcanic, metasedimentary, and plutonic rocks were identified. These, however, were not exhaustively studied.

Field work for this report was performed between May 23 and September 1, 1987. The crew consisted of the author, 1 senior assistant, and 3 junior assistants. Preliminary Map P.3122 , released in 1989, presents the survey's results.

Two sets of air photographs, taken in 1970 and 1978, and having a scale of 1:15 840 (1 inch to 1/4 mile) were used for field mapping. In addition, air photographs taken in 1986 (scale 1:20 000) were enlarged to a scale of 1:10 000 for use in field mapping, particularly in areas where logging and road construction occurred after 1978. Field data from the air photographs was plotted on base maps of the appropriate scale. The 1:10 000 scale base maps were later reduced to a scale of 1:15 840 and the data replotted.

Outcrops were reached and examined using pace and compass methods of traversing. The outcrop geology and boundaries of outcrop areas were plotted in the field on acetate overlays to the air photos. The data were transferred to cronaflex base maps prepared by the Cartography Section of the Surveys, Mapping, and Remote Sensing Branch of the Ontario Ministry of Natural Resources. The base maps, at scales of 1:15 840 and 1:10 000, were prepared from Forest Resources Inventory maps (scale 1:15 840 or 1 inch to 1/4 mile) of the Timber Branch of the Ontario Ministry of Natural Resources. Traverses were not spaced at regular intervals but rather were designed to intersect areas providing the most abundant outcrop. The geology is not tied to surveyed lines.

Acknowledgements

The author received able assistance in the field from Debbie Conrod, Heather James, Terry Konkin, and Mark Paoli. Debbie Conrod, in her capacity as senior assistant was responsible for mapping approximately 50% of the area.

The help and cooperation of the staff of the Regional Office of the Ontario Ministry of Natural Resources in Swastika is gratefully acknowledged as is the assistance given by employees of the Resident Geologist's Office, Kirkland Lake.

Special thanks are extended to Henry and Lise Batisse, proprietors of Camp Matachewan, for their hospitality and generosity.

Mineral Exploration

The area adjacent to Yarrow and Doon Townships has seen considerable prospecting activity, along with production from a number of mines. To the west, in Midlothian Township, gold discoveries led to prospecting and staking rushes in 1909, 1918, and again in 1944. In 1965, the Stairs Mine began gold production but closed after several months due to insufficient ore reserves and increased mining costs (Bright 1970). During the field season of 1987, the area around the site of the Stairs Mine was being re-evaluated by Goldteck Exploration Limited. To the north, in Bannockburn Township, the Ashley Mine produced gold in the years circa 1930. Immediately to the northeast of the map area, in Baden, Alma, Powell, and Cairo Townships, gold prospecting activity began in 1909 and reached a peak in the 1930's (Lovell 1967). The Young-Davidson Mine, owned by Hollinger Consolidated Gold Mines Limited, operated from 1934 to 1956 and produced 585,690 ounces of gold and 131,989 ounces of silver. The mineralization occurred in quartz-carbonate veins hosted by red syenite porphyry. Matachewan Consolidated Gold Mines Limited operated a mine from 1934 to 1954 and produced 370,427 ounces of gold and 133,710

ounces of silver. The mineralization occurred in quartz veins hosted by carbonatized, chrome-mica-bearing metavolcanic rocks (Lovell 1967).

In 1948, gold exploration was carried out on the Vandeventer Claims which lie approximately 2 km southwest of Mudpack Lake. Low gold values were reported from a quartz-vein system cutting highly deformed "granitized greenstone".

Between 1949 and 1952 Matarrow Lead Mines Limited drilled 30 holes totaling 2612 m in the metavolcanic rocks and banded iron formation of northwestern Yarrow Township. This exploration led to the development of the Matarrow Mine which operated from 1951 to 1953, producing lead from a sheared, silicified, and carbonatized Archean banded iron formation. In 1957, Maralgo Mines Limited explored for copper in quartz-veined and brecciated rocks in southeastern Yarrow Township; twenty-three holes were drilled totaling 911 m. In 1963 the Barker Mining Syndicate drilled 5 holes totaling 448 m in the course of a gold exploration program in sheared, carbonatized, metavolcanic rocks in northwestern Yarrow Township. In 1979, Newmont Exploration of Canada Limited performed magnetometer and VLF surveys on a claim group currently held by R.B. Schaus which lies in north-central Yarrow Township. Extender Minerals of Canada Limited currently produces barite from veins which cut rocks of the Gowganda Formation on the west shore of Mistinikon Lake.

In May, 1978, as a result of a legal dispute between the Province of Ontario and the Temagami Indian Band, a tract of land which includes the map area was closed to staking and recording of mining claims. This action is referred to as the

"Bear Island Caution". At the time of writing the case was scheduled to be heard before the Ontario Court of Appeal.

GENERAL GEOLOGY

The map area lies along the northwestern margin of the Cobalt Embayment of the Southern Structural Province of the Canadian Shield (Card et al. 1972). The oldest rocks in the area are Late Archean mafic to felsic flows and tuffs of the Larder Lake Group and of the Upper Deloro Group; the latter has been dated at 2725 +/- 2 Ma (MERQ-OGS, 1983). The Larder Lake Group is associated with Late Archean metasedimentary rocks of the Porcupine Group (MERQ-OGS, 1983) which consist of diamictite, banded chert-magnetite iron formation, and lithic wacke. The metavolcanic and metasedimentary rocks strike to the northeast and dip steeply to the southeast. They have been intruded by felsic plutonic rocks of the Round Lake Batholith which range in composition from granodiorite to granite (Lafleur and Hogarth 1981). The felsic plutonic rocks range from massive to gneissic and locally are highly deformed and mylonitized. All of these rocks have been intruded by diabase dikes of the Late Archean Matachewan swarm which has been dated at 2633 ± 93(1) Ma by Rb-Sr methods (Gates and Hurley 1973).

The Late Archean rocks are unconformably overlain by sedimentary rocks of the Early Proterozoic Gowganda Formation (Cobalt Group, Huronian Supergroup) which has been dated at 2240 +- 174 Ma by Rb-Sr methods (Fairbairn et al. 1969). This is probably a minimum age on the unit. In the Cobalt Embayment, the Gowganda Formation consists of the lower, glaciogenic, Coleman Member and the conformably overlying fluvial-deltaic Firstbrook Member (Donaldson et al. 1985).

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1 All ages in this report are the decay constants recommended in Steiger and Jager (1977).

Only rocks equivalent to the Coleman Member occur in the map area and consist of a heterogeneous assemblage of diamictite (polymictic paraconglomerate), sandstone, siltstone, and laminated mudstone with dropstones. Strata of the Gowganda Formation dip gently to the southeast.

Nipissing Intrusive Rocks, dated at 2219 +- 4 Ma (Corfu and Andrews 1986), intrude both the Late Archean and Early Proterozoic rocks. In the map area, Nipissing Intrusive Rocks are represented by a few small outcrops of fine-to coarse-grained, locally pegmatitic diabase.

TABLE 1

TABLE OF LITHOLOGIC UNITS FOR YARROW AND DOON TOWNSHIPS

PHANEROZOIC
CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT
Glacial, glaciofluvial, swamp, lake, and stream deposits

UNCONFORMITY

EARLY PROTEROZOIC
MAFIC INTRUSIVE ROCKS
NIPISSING INTRUSIVE ROCKS
Fine-to coarse-grained diabase; locally pegmatitic

INTRUSIVE CONTACT

HURONIAN SUPERGROUP
COBALT GROUP
GOWGANDA FORMATION
Diamictite, lithic arkose to feldspathic lithoarenite,lithic arkosic wacke to feldspathic lithwacke,siltstone, laminated mudstone with dropstones

UNCONFORMITY

LATE ARCHEAN
MAFIC INTRUSIVE ROCKS
Diabase (Matachewan diabase)

INTRUSIVE CONTACT

INTERMEDIATE INTRUSIVE ROCKS
Diorite

INTRUSIVE CONTACT

FELSIC INTRUSIVE ROCKS
GRANITIC ROCKS and GNEISSES
Gneissic granodiorite, xenolith-bearing gneissic granodiorite, cataclastic gneissic granodiorite and mylonite, foliated leucocratic granite, massive to foliated hornblende-rich granodiorite, aplite, pegmatite

INTRUSIVE CONTACT

METAVOLCANIC and METASEDIMENTARY ROCKS
METASEDIMENTARY ROCKS
Diamictite, banded magnetite-chert iron formation, lithic wacke

INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS
Pillowed, vesicular, and amygdaloidal flows, massive flows, tuff

LATE ARCHEAN

METAVOLCANIC AND METASEDIMENTARY ROCKS

Intermediate to Felsic Metavolcanic Rocks (Unit 1)

Three inliers within the Huronian rocks of Yarrow and Doon Townships expose easterly and northeasterly striking, mafic to felsic metavolcanic rocks (Unit 1).

In Doon Township, easterly striking, northwest-dipping intermediate metavolcanic flows occur east of Duncan Lake. The rocks are massive, aphanitic, and pale grey-green on both the fresh and weathered surfaces. In thin section the rock consists of actinolite laths surrounded by fine-grained chlorite. Very fine-grained quartz is present interstitially. These rocks are part of the Upper Varied Division of the Deloro Group (MERQ-OGS, 1983).

West of Elmer Lake, pillowed, amygdaloidal, and brecciated flows strike to the northeast and dip steeply to the southeast. The rocks are light greenish-grey to brown weathering. On a fresh surface they are medium to dark greenish-grey. The pillows are approximately 60 cm long -wide and 25 cm wide. Pillow selvages are 1 to 3 cm in width. Amygdules are 0.25 to 0.50 cm in diameter, are filled with carbonate and occur throughout the pillows. In thin section the amygdaloidal rock consists of thin laths and needles of altered plagioclase set in a groundmass of devitrified glass. The pillowed horizon grades to a flow-top breccia displaying light-grey weathering angular fragments, 0.5 cm-15 cm in diameter set in a brown-weathering, fine-grained matrix (Photo 2). Pillow shapes and the gradation to flow-top breccia indicate that the succession

is north-facing. These rocks are part of the Larder Lake Group (MERQ-OGS 1983).

Intermediate to felsic metavolcanic flows and tuffs are exposed by an inlier to the east of Mistinikon Lake in north-central Yarrow Township. The zone of metavolcanic rocks is 1.5 km in width and is truncated to the south by felsic intrusive rocks and is covered to the east and north by rocks of the Gowganda Formation. The metavolcanic rocks strike to the northeast and dip steeply to the southeast and are part of the Larder Lake Group (MERQ-OGS 1983). They are reddish-brown on both weathered and fresh surfaces and are typically massive and aphanitic. In thin section, the rock consists of highly sericitized plagioclase phenocrysts in a groundmass of very fine-grained recrystallized quartz. Alteration products are abundant granular masses of epidote, fibrous blades of actinolite, and minor amounts of chlorite. Tuffs are poorly exposed and display dark greenish-grey and brownish-grey bands approximately 1 cm in thickness.

Carbonatized and silicified metavolcanic rocks are present in a strongly foliated zone about 600 m in width which lies adjacent to the main access road a short distance south of the northern boundary of Yarrow Township.

Metasedimentary Rocks (Unit 2)

Metasedimentary rocks (Unit 2) are exposed west and northwest of Elmer Lake in Doon Township. Exposure of these rocks is obscured by a mantle of sand and gravel. The succession consists of diamictite, coarse-grained to pebbly, laminated to cross-stratified sandstone, and minor siltstone

and argillite. The clast composition of the diamictites is dominated by felsic to intermediate metavolcanic lithologies. Less abundant are clasts of mudstone, chert, banded iron formation, and mafic to ultramafic metavolcanic rocks. The clasts are mainly subangular to rounded, and range from 1 cm-30 cm in diameter (average 3 cm). The matrix of the diamictite is fine- to medium-grained sandstone in which ferroan-carbonate replacement alteration is common. The poor sorting and matrix-supported texture of the diamictites suggests deposition by debris flows. Cross-stratification and graded bedding in overlying strata are exposed in Midlothian Township and indicate that the succession faces northward.

The metasedimentary rocks exposed in Doon Township are correlative with a succession in Midlothian Township which is approximately 3 km-thick and consists of massive and stratified diamictite, cross-stratified, clast-supported pebble conglomerate, cross-stratified sandstone, and graded and laminated siltstone. The contact with underlying metavolcanic rocks was not observed in the map area, however in Midlothian Township a roadside outcrop displays a sheared contact between tuffs and diamictite. The lower part of the metasedimentary succession may represent a rapid transition from an environment of subaqueous resedimentation to one dominated by fluvial processes. This is followed by a return to a subaqueous environment which saw deposition of thin turbidites interbedded with tuffs. Hyde (1980) has suggested that these rocks represent the Timiskaming Group, whereas others consider them part of the Larder Lake Group (MERQ-OGS, 1983).

Banded chert-magnetite iron formation is interbedded with metavolcanic rocks on the east shore of Mistinikon Lake in northeastern Yarrow Township. The unit is approximately 60 m in width and is exposed along strike for about 1 km. The unit strikes to the northeast and dips steeply to the south. The rock consists of strongly folded, finely banded, alternating layers of silica and magnetite (Photo 3).

FELSIC INTRUSIVE ROCKS

Granitic Rocks and Gneisses (Unit 3)

Granitic rocks and gneisses (Unit 3) are exposed in the western half of Yarrow Township and form the northwestern margin of the Round Lake Batholith which is a composite body consisting of gneissic granodiorite, plus tonalite, granite, quartz monzonite, diorite, and syenite. The granitic rocks occur mainly as stocks and display both concordant and discordant intrusive relationships with the gneissic granodiorite (Lafleur and Hogarth 1981).

In the map area, rocks of the Round Lake Batholith are composed mainly of medium-grained gneissic granodiorite to tonalite which displays faint banding defined by differences in grain size and composition. The rock is light grey to pinkish-grey on the weathered surface and dark pinkish-grey on the fresh surface. A weak to moderate foliation is expressed by elongated masses of quartz and feldspar. In thin section the rock consists of large, strongly sericitized plagioclase laths surrounded by sutured quartz grains and orthoclase. Hornblende has been largely replaced by epidote and chlorite, whereas biotite has altered to chlorite (Photo 4).

In central Yarrow Township, is an east-trending zone, approximately 800 m in width, of highly-deformed xenolith-bearing gneissic granodiorite. The xenoliths are dark greenish-grey, fine-grained, and finely laminated. At some localities they appear to have been transposed into parallelism with the gneissic rocks (Photo 5). These zones display porphyroblasts which are deformed and indicate left-lateral shearing. At other outcrops, the xenoliths were observed to be caught up in, and deformed with the gneiss. In thin section, the rock consists of hornblende with a strong preferred orientation, and interstitial quartz. The hornblende has been partly altered to granular aggregates of epidote.

In southwestern Yarrow Township, the xenolith-bearing gneiss has been mylonitized. The rock is reddish-brown weathering and contains pink feldspar porphyroblasts, along with blebs and rootless folds of pink gneissic rock (Photo 6). In thin section, the porphyroblasts are strongly sericitized plagioclase which are surrounded by fibrous chlorite, quartz, and epidote. The chlorite is an alteration product of hornblende and displays a strong preferred orientation.

Foliated to massive leucocratic granite occurs in southeastern Yarrow Township on the eastern shore of Sisseney Lake, and in western Yarrow Township on the eastern shore of Mistinikon Lake. The rock is light-pink weathering and displays quartz phenocrysts up to 1 cm in diameter. On the fresh surface it is reddish-grey. In thin section, the rock consists of plagioclase, microcline, microperthite, and biotite. At one locality this rock type intrudes the mylonite

described above and hence post-dates the deformation event (Photo 7).

Hornblende-rich granodiorite occurs at a number of localities but is most abundant in southwestern Yarrow Township where it appears to form a stock and displays discordant relationships with the gneissic granodiorite. The rock is light grey to light pink on both the fresh and weathered surfaces. Hornblende crystals range up to 1 cm in length and locally define a mineral lineation. In thin section, the rock consists of large, strongly sericitized, plagioclase laths and K-feldspar with interstitial polycrystalline quartz. Large hornblende crystals are strongly altered to epidote and chlorite. Biotite, titanite, and zircon are minor constituents (Photo 8).

Light grey quartzofeldspathic veins, 1 to 10 cm in width, are abundant in the gneissic granodiorite and are cross-cut by thin pegmatite veins. Both types of veins are absent from the xenolithic gneiss and mylonitic zones and are rare in the leucocratic granite and in the hornblende-rich granodiorite.

Lafleur and Hogarth (1981) suggest that the Round Lake Batholith was emplaced in a mafic volcanic sequence as a magmatic diapir. The intrusion cooled and partly solidified as it moved upward in the dense mafic volcanic sequence. This would account for the foliated and cataclastic nature of the early granodiorite and the massive nature of the later granites. Jensen and Langford (1985) envisage the generation of batholiths in the Abitibi Belt as a process involving downward faulting, buckling, and tilting of calc-alkalic

volcanic rocks which underwent partial melting to produce diapirs of felsic magma.

Intermediate Intrusive Rocks

Diorite (Unit 4)

Diorite (unit 4) is exposed at two localities along the shore of Mistinikon Lake: a small outcrop on the south side of the bridge which crosses Mistinikon Lake, and on a point 1 km south of the bridge. The distribution of outcrops suggests that rock is a dike although contacts with the surrounding rocks were not observed. The rock is dark brown to tan weathering. On a fresh surface, green plagioclase phenocrysts up to 3 cm long are visible and have an east to northeasterly long-axis orientation. The phenocrysts are set in a pink to dark brown groundmass. In thin section, the rock has an ophitic texture comprised of plagioclase, pyroxene, and minor K-feldspar; chlorite, epidote, and carbonate are alteration products.

Mafic Intrusive Rocks

Matachewan Diabase (Unit 5)

Matachewan diabase dikes (unit 5) are abundant in the map area. They are typically 5 to 10 m in width and trend slightly west of north. They are best exposed in Yarrow Township where they intrude the felsic rocks of the Round Lake Batholith. Good exposures are also found in the cleared area of west-central Doon Township where the dikes intrude metavolcanic rocks. The diabase is light brown to reddish-brown on the weathered surface and displays white-weathering plagioclase

laths up to 4 cm in length which commonly show a preferred orientation. Plagioclase glomerocrysts are up to 3 cm in diameter. The rock is dark green on the fresh surface. In coarser-grained dikes, ophitic texture is visible on both fresh and weathered surfaces. The dikes are massive, fine- to coarse-grained, and are magnetic. In thin section, the rock displays a subophitic texture of sericitized plagioclase, and augite. These are surrounded by interstitial quartz, chlorite, and opaque grains of magnetite.

EARLY PROTEROZOIC

HURONIAN SUPERGROUP

Cobalt Group

Gowganda Formation

In the Cobalt area, the Gowganda Formation consists of two members. The glaciogenic Coleman Member unconformably overlies the Late Archean basement and ranges in thickness from 200 m to >500 m (Mustard and Donaldson 1987). Evidence for the glacial origin of the Coleman Member includes the presence of diamictites and dropstones. This is gradationally overlain by the fluvial-deltaic Firstbrook Member which reaches a maximum thickness of approximately 530 m (Rainbird 1986).

Lower Gowganda Formation (Coleman Member) (Unit 6)

In the map area the Lower Gowganda Formation rests unconformably on the Archean basement and contains diamictites and dropstone-bearing siltstones and is therefore equated with the Coleman Member of the Cobalt area. The only Huronian rocks in the map area are those of the Coleman Member which attain a

maximum thickness of 200 m. The succession locally forms a coarsening-upward cycle beginning with approximately 45 m of siltstone, laminated mudstone-siltstone, laminated mudstone-siltstone with dropstones, and minor diamictite (polymictic paraconglomerate) and sandstone. The remainder of the succession is approximately 155 m of interbedded diamictite and sandstone and minor beds of siltstone (Figure 2).

Rock Descriptions

Siltstone is apparently massive and is dark greenish-gray on both fresh and weathered surfaces. Angular, pink, feldspathic rock fragments, 1 mm to 2 mm in diameter, are commonly visible in hand specimen as are lenses of pink to dark-red weathering, fine-grained sandstone which are approximately 1 cm thick and 5 cm long. In thin section the rock consists of angular to subrounded silt-sized grains in a matrix of chlorite and sericite which represent original clay constituents. The silt-sized grains are comprised of quartz, plagioclase, K-feldspar, and rock fragments (mudstone, metamorphic quartz-feldspar aggregates, and wacke clasts or "till pellets" (Photo 9). Faint stratification is defined by discontinuous single grain layers, subtle changes in grain size, and normal grading.

Laminated mudstone-siltstone presents a banded appearance on the weathered outcrop surface (Photo 10). Siltstone laminae weather to a medium brownish-gray colour whereas mudstone laminae are light-gray weathering. On a fresh surface, both rock types are dark greenish-gray. Laminae range in thickness from 0.5 mm to 2 mm. The siltstone laminae commonly display

pink-weathering, feldspathic rock fragments 1 mm to 2 mm in diameter. Also present are rare dropstones up to 3 mm in diameter. Mudstone laminae are gently undulatory and conform to irregularities in underlying siltstone laminae which are normally graded. This unit is also distinguished by discontinuous bodies, centimetres to decimetres in diameter, of pink fine-grained sandstone. These are circular to irregular in shape, thin (<5 cm), and commonly display contorted laminae and have resulted from soft-sediment deformation and lateral slumping (Photo 11). In thin section, laminated mudstone-siltstone consists of rhythmic alterations of coarse-fine laminae. The fine-grained laminae are chlorite and sericite and show very fine stratification and single-grain layers of silt-sized material. The coarser-grained laminae display angular to subrounded, silt-sized grains of quartz, feldspar, and rock fragments in proportions similar to those found in the massive siltstone described above. The coarse-grained laminae are normally graded and show evidence of scouring.

Laminated mudstone-siltstone with numerous dropstones is probably a lateral equivalent of the unit described above. The dropstones range from 1 cm to 15 cm in diameter. The larger clasts strongly deform underlying sediment and have been draped by overlying laminae (Photos 12, 13). Clast types are similar to those found in the diamictites and consist of pink quartz-phyric granite, granodiorite, mafic to felsic metavolcanic rocks, diabase, and vein quartz. Also present are normally graded laminae of siltstone and fine-grained sandstone.

Diamictite comprises approximately 40% of the Gowganda Formation in the map area. A diamictite is defined as a poorly

sorted, non-calcareous, terrigenous sedimentary rock that contains a wide range of particle sizes, typically clasts of pebble to boulder size supported by a muddy matrix (Bates and Jackson, 1987).

Massive diamictites are light to dark greenish-gray on a weathered surface and dark greenish-gray on a fresh surface. Clasts range from 0.5 cm to 90 cm in diameter (average 3 cm), make up 2% to 20% of the rock, and are supported by a siltstone matrix. The clasts are typically subangular to subrounded and are dominated by pink, quartz-phyric granite (45%) and granodiorite (35%). The remainder of the clast types are mafic to felsic metavolcanic rocks (12%), vein quartz (3%), diabase (3%), metasedimentary rocks (1%), and schist (1%). Massive diamictites are thickly to very thickly bedded and typically display sharp contacts with other units. Loading of underlying beds occurs at the bases of some units. Lenses of diamictite, approximately 1 m thick and 4 m long were observed within sandstone beds (Photo 14). Clasts within these lenses are more closely packed than in massive diamictite beds. Inverse grading of clasts and soft-sediment deformation was also observed. In thin section the diamictite matrix consists of angular to subrounded, silt-sized grains of quartz, feldspar and rock fragments set in a matrix of chlorite and sericite. Rounded detrital grains of apatite and zircon were also observed. Small amounts of carbonate and hematite are present as cement.

Stratified diamictites are less abundant in the local succession than are massive diamictites. They were observed in good exposures near the property of Extender Minerals of Canada

Limited on the west shore of Mistinikon Lake. The stratified diamictites display very thin beds defined by matrix grain size differences and feldspar content. The matrix of the stratified diamictites is slightly coarser-grained than that of massive diamictites, ranging from siltstone to fine-grained sandstone. The clast composition is similar to the massive diamictites, but the average clast size (2 cm) is smaller. Units of stratified diamictite are 1 m to 2 m thick and have gradational contacts with massive diamictite and sandstone.

In a detailed study of the area, Knightly (1987) observed a clast a-axis orientation to the east-southeast and to the south-southwest. Small recumbent flow folds indicate slumping toward the southeast. Evidence for soft-sediment deformation includes ball-and-pillow structures and flame structures. Rare trough cross-bedding suggests the presence of northwesterly directed traction currents. Dropstones were observed which deform underlying sandstone wisps.

Sandstones (arenite, wacke) are interbedded with diamictites and comprise the other dominant rock type in the succession. The arenites are fine to coarse grained and medium to thickly bedded. Lower contacts are typically sharp. Arenites range in composition from lithic arkose to feldspathic lithoarenite (classification of Dott 1964) (Figure 3). In outcrop, both are pink to red on weathered and fresh surfaces and typically are massive in appearance. Rarely, parallel lamination, cross-lamination, thin bedding, and shallow scour surfaces are present and are defined by differences in grain size and feldspar content. Some beds of coarse-grained arenite contain rip-up clasts of mudstone which have been deformed

during resedimentation. Decimetre-scale syn-sedimentary folds are exposed in roadside outcrops to the west of Mistinikon Lake. In thin section, lithic arkose displays poor sorting and consists of angular to subrounded detrital grains of quartz 45%, feldspar (plagioclase > K-feldspar) 35%, and rock fragments (metamorphic, plutonic, diabase) 20%. Apatite and zircon are minor (<1%) constituents. Interstitial sericite, hematite, and carbonate comprise less than 5% of the rock (Photo 15). Feldspathic lithoarenite is less abundant than lithic arkose and is distinguished by a greater percentage of rock fragments (30%-35%) (Figure 3).

Wacke is dark gray on both fresh and weathered surfaces and is typically massive. The composition ranges from lithic arkosic wacke to minor feldspathic lithwacke (classification of Dott 1964) (Figure 3). In thin section, lithic arkosic wacke is very poorly sorted and consists of detrital grains (quartz, feldspar, rock fragments) which occur in similar proportions to those in the arenites. The matrix comprises approximately 15% of the rock and consists of angular to subrounded silt-sized detrital grains set in chlorite and sericite. Feldspathic lithwacke is less abundant than lithic arkosic wacke and is distinguished by a greater percentage (30%-40%) of rock fragments.

Siltstone is the least common rock type in the upper part of the succession. It is commonly parallel-laminated to wavy-bedded; cross-lamination is rare. Bedding thickness ranges from 10 cm to 1 m, with an average of 20 cm.

Basal strata of the Coleman Member are exposed along roadsides and in cleared areas to the northwest of Elmer Lake

in Doon Township where beds of the Coleman Member lie at the same topographic level as Archean metavolcanic rocks less than 0.5 km distant; the unconformity surface was not observed. The basal strata consist of massive siltstone and laminated mudstone-siltstone, with rare interbeds and lenses of diamictite, arenite, and wacke.

Basal strata of the Coleman Member were also observed in central Yarrow Township where they lie in close proximity to felsic plutonic rocks of the Round Lake Batholith. The unconformity surface was not observed. In the central and south-central parts of the township the basal strata are mainly interbedded diamictite and wacke. In the north-central part of the township, basal strata are massive siltstone and laminated mudstone with dropstones.

The upper part of the succession which is dominated by diamictite and sandstone is exposed in Doon Township by hills which lie to the east and west of Elmer Lake, and to the southeast of Mistinikon Lake. Good exposures are also found to the east and west of the unnamed lake in north-central Doon Township. In Yarrow Township, the upper part of the succession is exposed by hills lying to the west of Sisseney Lake and to the southwest of Matachewan. Good exposures of diamictites and sandstones are seen in the roadcut adjacent to the property of Extender Minerals of Canada Limited.

Depositional Environment

Introduction

The Gowganda Formation has long been considered to be of glacial origin. Coleman (1908) interpreted the unstratified diamictites of the lower part of the Gowganda Formation in the Cobalt area to be the deposits of continental glaciation. Lindsey (1969) proposed a terrestrial to freshwater-lacustrine depositional environment for the Coleman Member of the Cobalt area and a glaciomarine setting for the lower Gowganda Formation in the Sudbury-Espanola area. Miall (1983) has suggested a glaciomarine origin for rocks in the northern Cobalt embayment which are stratigraphically equivalent to the Coleman Member. Mustard and Donaldson (1987) interpret the Coleman Member in the Cobalt area as the deposits of a locally grounded ice sheet followed by subaqueous outwash deposition in front of a slowly retreating tidewater glacier. This was followed by sedimentation from a partially floating ice sheet.

The rock units discussed below are interpreted in the context of a model of glaciomarine sedimentation involving a major ice sheet fed by continental glaciers (Drewry 1979; Thomas 1979; Miall 1983) (Figure 4). The ice sheet was situated over a continental margin and may have been grounded on the marine shelf or on topographic highs such as areas of elevated bedrock lying deeper within the basin (see Miall 1983; Figure 6).

Interpretations

Siltstones which display faint stratification and normal grading were deposited from suspension, and by thin turbidites

representing the distal edge of the zone of gravity flows in a hemipelagic environment (Miall 1983). Wacke clasts ("till pellets") are frozen aggregates of glacial debris which were deposited by melt-out from shelf ice or icebergs. Small sandstone lenses ("starved ripples") indicate the presence of weak traction currents which reworked the minor amounts of sand deposited from melt-out or by turbidity flows.

Laminated mudstone-siltstone couplets displaying normal grading and evidence of scouring are the products of thin turbidity flows. The regularity of the mudstone-siltstone layers and the presence of scour surfaces indicate deposition in a gravity flow zone more proximal than that of the siltstone described above. Dropstones attest to the continued presence of floating ice. Ball-and-pillow structures and deformed sandstone bodies may have originated as "starved ripples" formed by traction current activity; these ripples later foundered as a result of density-induced loading (Miall 1983).

Massive diamictites, consisting of poorly sorted material and displaying a preferred long-axis orientation of clasts, are the products of debris flows which originated near the ice-shelf grounding line. At such locations (continental shelf, topographic highs) ice-push, oversteepening, or isostatic adjustment of the basin related to ice advance and retreat can trigger resedimentation of glacial debris. A modern analog for this depositional environment has been described from Antarctica by Kurtz and Anderson (1979). Lenses of massive diamictite within stratified diamictite and sandstone are the result of iceberg overturn. This process occurs when newly-calved icebergs undergo melting, become unstable and capsize

depositing englacial debris which has accumulated on the surface of the iceberg (Ovenshine 1970).

Stratified diamictites resulted from a combination of normal marine sedimentation and deposition from floating ice. Dropstones and diamictite lenses are the result of ice-rafting. Trough cross-stratified sandstones and small sandstone wisps and lenses were created by normal marine currents which reworked glacial debris. Similar deposits are reported from the Antarctic continental shelf (Kurtz and Anderson 1979). Gradational contacts of stratified diamictites with other units in the map area are also observed in the sediments of the Antarctic continental shelf and reflect the gradual onset and decline of ice-rafting episodes.

Massive to parallel-laminated sandstones with scour structures, penecontemporaneous deformation structures, and rip-up clasts are attributed to deposition from gravity flows which originated on the flanks of subaqueous outwash lobes. Where grounded ice is retreating, considerable amounts of subglacial meltwater carry debris to the ice-front where lobes of sand and silt are formed (Rust 1977). Being water-saturated and unstable, these sediments are easily liquefied and tend to form gravity flows which can move downslope for considerable distances. Normal marine sedimentation resumed between gravity-flow events and is recorded by rare, thin, interbeds of ripple cross-laminated sandstone and wavy-bedded siltstone which were deposited by weak traction currents.

Rapid lateral changes in glaciomarine facies are emphasized by the variation in basal strata in the map area. In Doon Township, basal strata are mainly the fine-grained

deposits of turbidites and ice-rafting; discontinuous units of diamictite and sandstone may represent isolated or distal debris flows. In contrast, the basal strata of Yarrow Township are mainly diamictites and sandstones deposited by coarse-grained debris flows. The remainder of the succession in both areas was subsequently dominated by debris-flow deposition. The lateral variability of rock types and the absence of any marker horizons prevented correlation among various exposures in the map area.

Studies of the Lower Gowganda Formation (Coleman Member) Adjacent to the Map Area

The glacial origin of the lower Gowganda Formation has been studied in some detail at locations near the map area. Miall (1983) has described a 400 m-thick succession observed in drill core from Fallon Township which lies 40 km north of the map area. The succession consists of interbedded fine-grained sediments with dropstones, plus sandstones and diamictites. Deposition was related to a major ice-shelf and was dominated by resedimentation of glacial debris via gravity flows on subaqueous outwash fans, by debris flows generated near the line of ice-grounding, and by ice-rafting.

A succession ranging up to 1600 m in thickness has been described from the Gowganda-Elk Lake area which lies 20 km to the south of the map area (Mackean 1968; Rosen 1985). The succession, consisting mainly of diamictite, sandstone, and siltstone, is interpreted as the record of a major ice-shelf where debris flows and ice-rafting were dominant processes (Rosen 1985). The basal unconformity and immediately overlying

strata display evidence for a variety of depositional environments. Subaerial exposure is indicated by the presence of a regolith, striated basement rock, and fluvial deposits. Elsewhere the basement has been eroded to a smooth surface and is overlain by dropstone-bearing siltstone.

In the Cobalt area, basal rocks of the Coleman Member include a regolith, breccia, and massive diamictite which are interpreted as the subglacial deposits of a grounded ice-sheet (Mustard and Donaldson 1987). The remainder of the succession, consisting of sandstones, diamictites, and siltstones, was deposited as subaqueous outwash fans, by resedimentation of glacial debris, and by ice-rafting.

MAFIC INTRUSIVE ROCKS

Nipissing Intrusive Rocks (Unit 7)

Nipissing Intrusive rocks (unit 7) are exposed in the map area by a number of isolated outcrops. In Doon Township the larger of these outcrops are found: to the east of Duncan Creek, northwest of Elmer Lake, and on the western shore of Elmer Lake. In Yarrow Township sizeable outcrops are located to the east of the main gravel road, and along the eastern shore of an unnamed lake in the southeastern part of the township. The largest outcrops in both townships are possibly erosional remnants of a once larger body and occur near the Late Archean-Early Proterozoic unconformity along which the rocks were probably intruded.

Nipissing Intrusive rocks in the map area are typically fine- to coarse-grained diabase. They weather to a reddish-brown colour and display a crude ophitic texture on the weathered surface. The rocks are greenish black and massive on a fresh surface. "Varied texture" is typical of the Nipissing rocks and is seen in hand specimen in the outcrop which lies to the east of Duncan Creek. The texture consists of irregular pods of pegmatitic gabbro within fine- to medium-grained diabase. In thin section, the rock is comprised of a coarse ophitic to sub-ophitic texture of saussuritized plagioclase along with uralitized augite. Interstitial minerals are quartz and graphic quartz-feldspar intergrowths. Magnetite and ilmenite comprise the opaque grains.

CENOZOIC

QUATERNARY

Pleistocene and Recent

Pleistocene and Recent deposits cover 70% to 80 % of the map area. Ice movement during Pleistocene glaciation was toward the southeast as indicated by striations on bedrock surfaces. Ground moraine consisting of gravel and sand forms the ground cover over most of the map area. The western part of Doon Township is mantled by the sand deposits of a glaciofluvial outwash plain. A south-trending esker lies to the east of Kame Lake. Two parabolic sand dunes were observed north of Duncan Lake. Their curvature indicates that the prevailing wind direction in post-glacial time was toward the southeast. For further details regarding the Quaternary deposits of the map area see Roed and Hallett (1979). Isolated swamps are found along the flood plain of Duncan Creek and around the shores of Kame Lake. Otherwise the area is dry and well-drained.

STRUCTURAL GEOLOGY

Folds

The reconnaissance nature of this study did not permit a thorough examination of the structural geology of Yarrow and Doon Townships. In addition, the Archean metavolcanic and metasedimentary rocks are poorly exposed. In both townships these rocks possess a northeasterly trending foliation which dips steeply to the southeast. The rocks exposed by the inlier in southern Doon Township strike to the northeast and dip to the northwest. In the metasedimentary rocks the foliation is generally parallel to bedding planes. Parasitic Z-folds in the banded iron formation in Yarrow Township plunge 70' to the northeast.

The gneissic felsic rocks of the Round Lake Batholith in Yarrow Township possess a northeast-trending gneissosity which is vertical or dips steeply to the northwest. Within the gneiss are discrete areas of intensely deformed to mylonitic rocks which may represent xenoliths of pre-existing metavolcanic or intrusive rocks. The rocks possess a northeast-trending foliation which dips steeply to the northwest. The horizontal component of shearing is left-lateral. It is emphasized that these zones were not traced out in detail.

Faults

Two major northeast-trending faults occur in Yarrow Township and are expressed by Mistinikon Lake and by Sisseney Lake. Both faults separate the Gowganda Formation from the Archean felsic intrusive rocks of the Round Lake Batholith.

Observations in Powell Township by Dyer (1935) indicate that the strata on the west side of the fault marked by Mistinikon Lake have been displaced approximately 900 m to the south. Movement along the Sisseney Lake fault has been mainly vertical.

Northeast- and northwest-trending joint sets occur in the Gowganda Formation. Local variations in strike and dip indicate post-depositional block faulting.

TABLE 2: LIST OF PROPERTIES AND UNCLAIMED PARCELS OF EXPLORED LAND IN YARROW AND DOON TOWNSHIPS. INFORMATION FROM THE ASSESSMENT FILES RESEARCH OFFICE, ONTARIO GEOLOGICAL SURVEY, TORONTO. DATE IN BRACKETS INDICATES LAST YEAR OF WORK.

NAME	TYPE OF WORK
Yarrow Township	
Vandeventer Claims (1948)	GR, T
Matarrow Lead Mines Limited (1949)	A, DDH, GR, T
Matarrow Mine (1952)	A, GR, MD
Maralgo Mines Limited (1957)	A, DDH
Barker Mining Syndicate / Christie Claims (1964)	A, T
Newmont Exploration of Canada Limited, Amorcan Property (1979)	EM
L. Harvey (1979)	DDH, T
R.B Schaus Property	**
Extender Minerals of Canada Limited	A, MD, T
Doon Township	
Canadian Aero Mineral Surveys Limited (1963)	EM
The Coniagas Mines Limited (1945)	EM, T
Laroma-Midlothian Mines Limited (1964)	DDH
Bagdad Exploration Associates Limited (1979)	GSS

Abbreviations

A	Assay
DDH	Diamond Drill Holes
EM	Electromagnetic Survey
GSS	Geochemical Soil Sampling
GR	Geological Report
MD	Mine Development
T	Trenching
**	Inactive due to Temagami Indian Land Claim (Bear Island Caution)

ECONOMIC GEOLOGY

Descriptions of Properties and Unclaimed Parcels of Explored Land

Bagdad Exploration Associates Limited (1979) (1)2

In 1979, the company held four claims along the gravel road in the area between Elmer Lake and Kame Lake. The area is underlain by metavolcanic and metasedimentary rocks and is thinly mantled by sand and gravel. A geochemical soil survey was performed which reported low gold values but anomalous Ag (>0.6 ppm), Hg (>350 ppb), Cu (98ppm), Pb (158 ppm), and Zn (200 ppm).

Barker Syndicate (1964) (2)

Fifteen claims in northern Yarrow Township (previously known as the Christie claims) were held by the Barker Syndicate of Buffalo, New York. The claims include gold-bearing sheared, silicified, and carbonatized metavolcanic rocks. The showings were examined by W.S. Savage, Resident Geologist, Kirkland Lake who was informed that samples from trenches had assayed $5.00 over 2.7 m, and $18.00 over 2.3 m (U.S. $35/ounce). A syenite porphyry reported by the previous claim holder, R. Dingle, was not found.

Canadian Aero Mineral Surveys Limited (1963) (3)

In 1963 Canadian Aero Mineral Surveys Limited conducted airborne magnetometer and electromagnetic surveys.

Extender Minerals of Canada Limited (4)

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2 Number in brackets is property, occurrence number on map (back pocket).

The company operates a barite mine on the west shore of Mistinikon Lake and holds four claims adjacent to the mine site (claims 4222, 4223, 4328, 4329). The barite occurs as veins 3m to 5m in width which strike to the northwest from the fault along Mistinikon Lake. Assay values reported by the company range from 76% to 89% barium sulphate.

Harvey, L. (1979) (5)

Exploration consisting of numerous pits and one drill hole was performed by L. Harvey from 1977 to 1979 on the western and eastern shores of Mistinikon Lake in southwestern Yarrow Township. The area is underlain by granite and xenolith-bearing gneissic granodiorite which are intruded by numerous chalcopyrite- and pyrite-bearing quartz veins.

Laroma-Midlothian Mines Limited (1964) (6)

In 1964, Laroma-Midlothian Mines Limited drilled one hole to a depth of 121 m in Archean tuffs and syenite porphyry.

Maralgo Mines Limited (1957) (7)

In 1957, Maralgo Mines Limited carried out a copper exploration program on four claims in extreme southeastern Yarrow Township. Exploration was focused on chalcopyrite-bearing quartz veins and associated breccias in sedimentary rocks of the Gowganda Formation. Twenty-three holes were drilled totaling 911 m. The highest copper value was 19%, average values were <1%.

Matarrow Lead Mines Limited (1952) (8)

Thirty-six claims were held in northwestern Yarrow Township to the east of Mistinikon Lake. The claims were centered on a northeast-trending zone of foliated metavolcanic rocks and banded iron formation. The banded iron formation is 60 m in width and extends for 2 km along strike. It hosts sphalerite and galena bearing carbonate veins in "veined shatter zones". From 1948 to 1952, thirty holes, totaling 2612 m, were drilled along strike.

The mineralization was described as follows by company geologist E.K. Fockler:

The vein matter consists usually of altered, well-fractured, soft, chloritic material and contained calcite veining and galena-sphalerite mineralization. The vein proper frequently is characterized by a central replacement band, from one to two feet in width, of relatively massive, finely crystalline galena. Galena is also noted on fractures and in calcite seams over widths of 3 feet or more on either side of the main mineralization. Sphalerite tends to be largely disseminated through the more siliceous or cherty material on either side of the main galena mineralization although seams, stringers, and clusters of massive sphalerite are associated with the galena.

Assay results from drilling and trenching along an 800 feet (240 m) strike length gave average values of 6.73% lead, and 2.56% zinc over a core length of 8.3 feet (2.5 m).

Matarrow Mine (1953) (9)

The area around the mine had been explored for lead and zinc as early as 1928 when it was known as the Robb Option. By

1951, underground development had begun based on drilling performed in the winter of 1948-1949 (see Matarrow Lead Mines Limited above). The drilling had intersected two roughly parallel carbonate veins dipping steeply to the south. A three compartment shaft was begun and sunk to a depth of 57 m. A total of 172 m of drifting was then performed. Ore sections totaling 145 m averaged 9.3% lead and 4.3% zinc over a sample width of 1.4 m. The ore reserves were estimated to be 28,000 tons grading approximately 7.5% lead and 3.5% zinc. In 1951, control of the mine was assumed by Matachewan Consolidated Mines Limited. Poor ore grades at lower levels forced the closing of the mine after the mining of level 1 in 1953.

Schaus, R.B., Clark, D.L. and Shirriff, J.F. (10)

Magnetometer and VLF surveys were performed in 1979 by Newmont Exploration of Canada Limited on a group of eight claims held by Amorcan Mines Limited. The property is underlain by gold-bearing sheared, silicified, and carbonatized metavolcanic rocks and is part of the claim group previously held by the Barker Syndicate. The exploration program was to have included mapping and sampling. The area, however, was included in the Bear Island Caution in 1979. This property is now part of a claim group (29666 to 29672 inclusive; 29675, 29676) held by R.B. Schaus, D.L. Clark, and J.F. Shirriff.

The Coniagas Mines Limited (1945) (11)

In 1945, the company held fifteen claims in west-central Doon Township. Geomagnetic surveys delineated a northeast-trending anomaly (700-900 gammas) which was coincident with

sheared, carbonatized, and silicified metavolcanic rocks. Another anomaly was produced by a north-trending cross-fault. Minor trenching was performed.

Vandeventer Claims (1948) (12)

Twelve claims were held by L. Campbell in north-central Yarrow Township. The claims lay to the east of a small unnamed lake 1.5 km southeast of the junction of the main road and the north-south logging road. They surround a quartz-vein system which occupies a northeasterly trending fault zone. In 1940, a consulting geologist's report described the veins as representing a potential low-grade gold deposit, although no assay values were published. The quartz veins are up to 12 m wide and contain chalcopyrite, pyrite, galena, and specularite. Also present are northeast-trending syenite porphyry dikes. The fault zone lies within the mafic xenolith-bearing zone of the gneissic granodiorite of the Round Lake Batholith.

Recommendations for Exploration

Archean Inliers

Although economic concentrations of gold have not yet been found in Yarrow and Doon Townships, the area warrants future exploration. The Archean metavolcanic rocks are affected by shearing associated with the intrusion of the Round Lake Batholith. In addition, the westerly extension of the Kirkland Lake-Larder Lake fault zone may lie immediately north of the map area in Powell and Cairo Townships.

An assayed sample of carbonatized, intermediate metavolcanic rock from north-central Yarrow Township yielded a

gold content of 660 ppb. A grab sample of brecciated, quartz-veined, banded iron formation was taken from an old pit in felsic intrusive rocks to the south of the bridge over Mistinikon Lake. The sample gave an assay value of 300 ppb gold.

Two past producers of gold are located adjacent to the map area: the Young-Davidson Mine in Powell Township, and the Stairs Mine in Midlothian Township. The latter is currently being re-evaluated by Goldteck Exploration Limited.

Huronian Supergroup

The Huronian Supergroup has recently been studied for its potential to host Witwatersrand-type paleoplacer gold deposits (Colvine 1981; Long and Leslie 1982; Mossman and Harron 1984). The favourable sites for such concentrations are in the deposits of braided streams in an alluvial fan setting (Mossman and Harron 1984) and possibly in glaciofluvial outwash deposits (Long and Leslie 1982). Fluvial and glaciofluvial strata were not observed in the course of this study and hence the prospects for placer gold concentrations in Yarrow and Doon Townships are poor.

A sample of coarse-grained feldspathic lithoarenite from strata of the Gowganda Formation exposed along the roadcut west of Mistinikon Lake gave an assay value of 21 ppb gold. These strata are interpreted to be the deposits of a proglacial subaqueous outwash fan (Knightly 1987).

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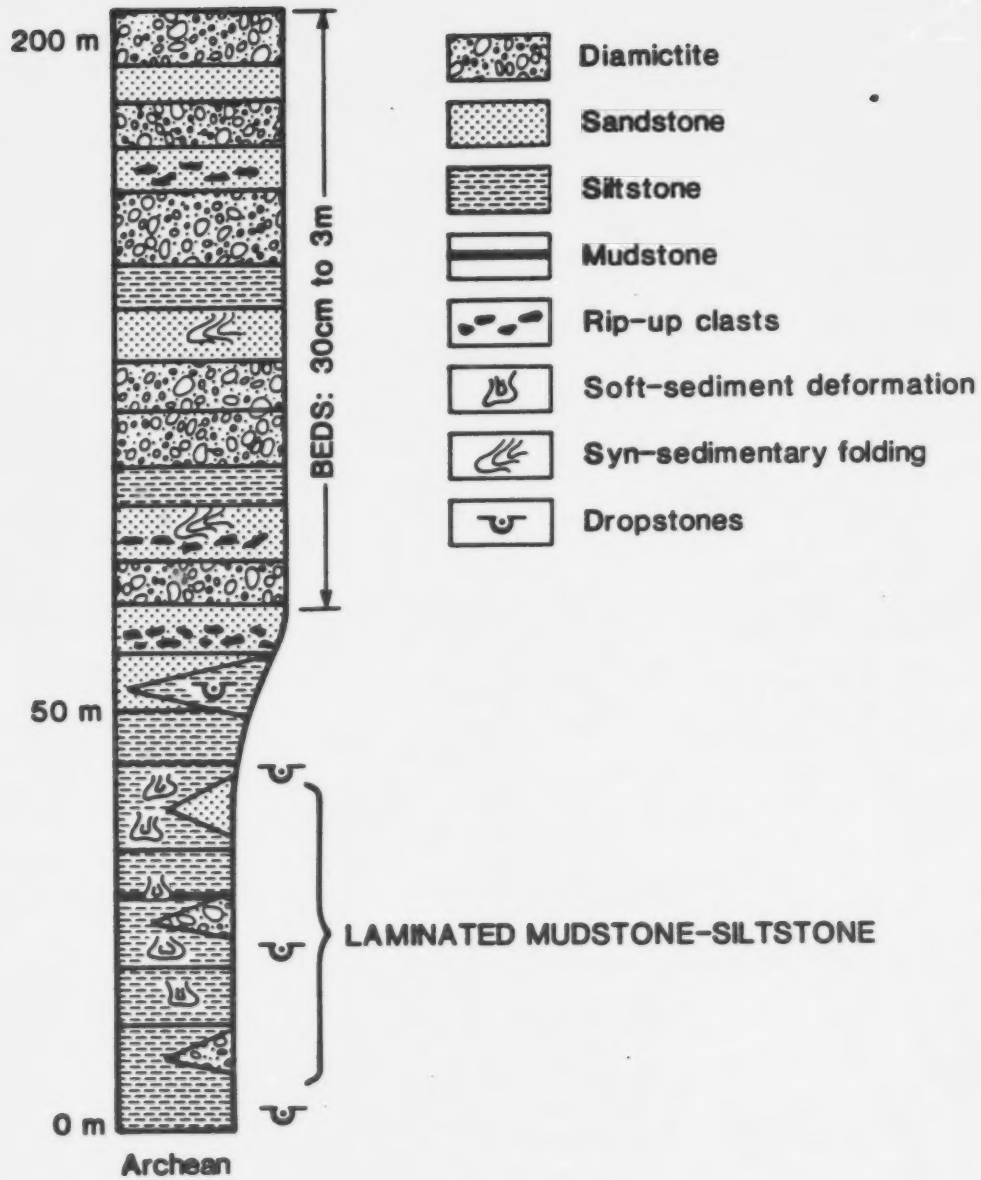

Figure 2 Generalized diagram of the stratigraphy of the Gowganda Formation in Yarrow and Doon Townships.

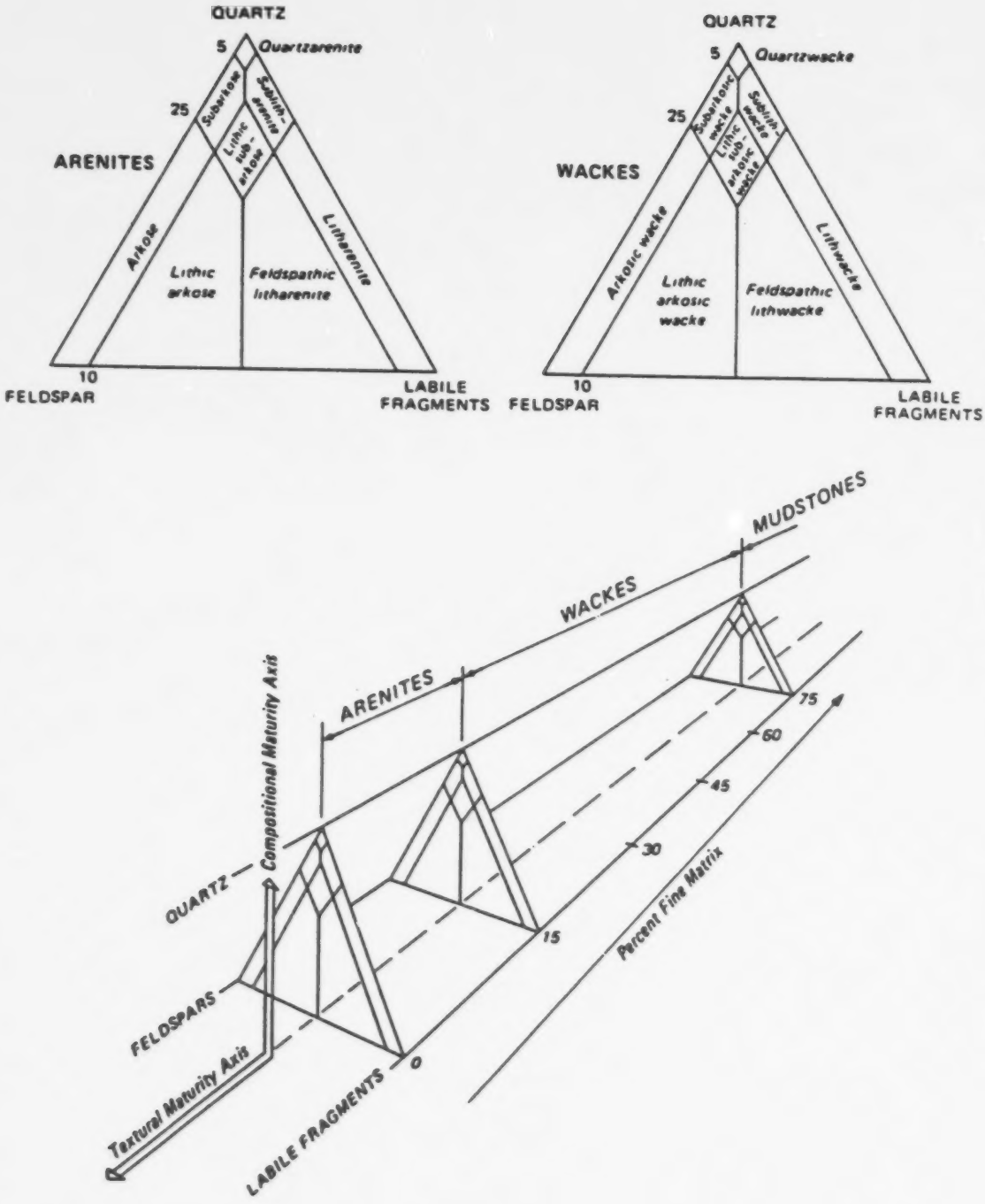

Figure 3 Sandstone classification diagram (modified from Dott 1964).

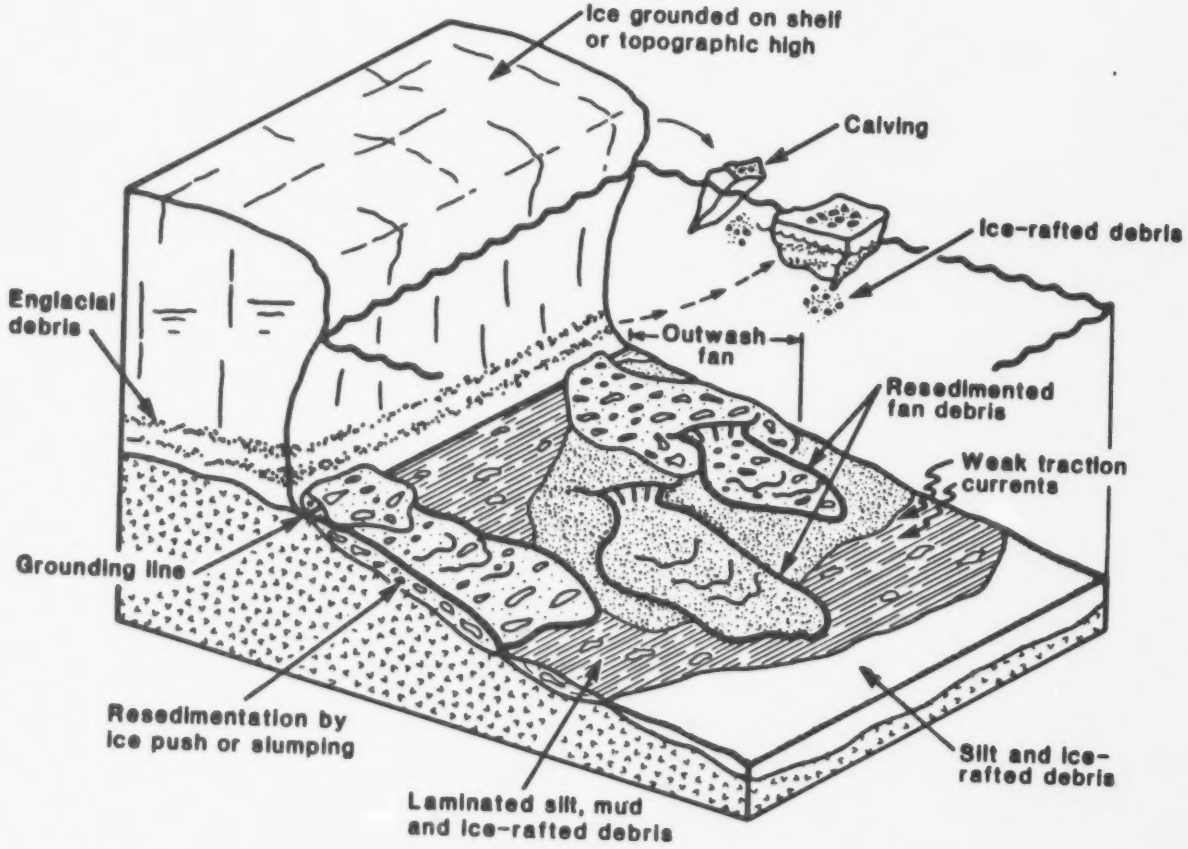

Figure 4 Model for glaciomarine sedimentation depicting an ice-sheet grounded on the continental shelf or on a topographic high within the basin. A floating ice-shelf can be present at the foot of the glacier. The scale of this environment can range up to several tens of kilometres (after Mustard and Donaldson 1987).

Photo 1 View looking southwest in Doon Township toward gently dipping strata of the Gowganda Formation. The hills lie on the southwest shore of Elmer Lake.

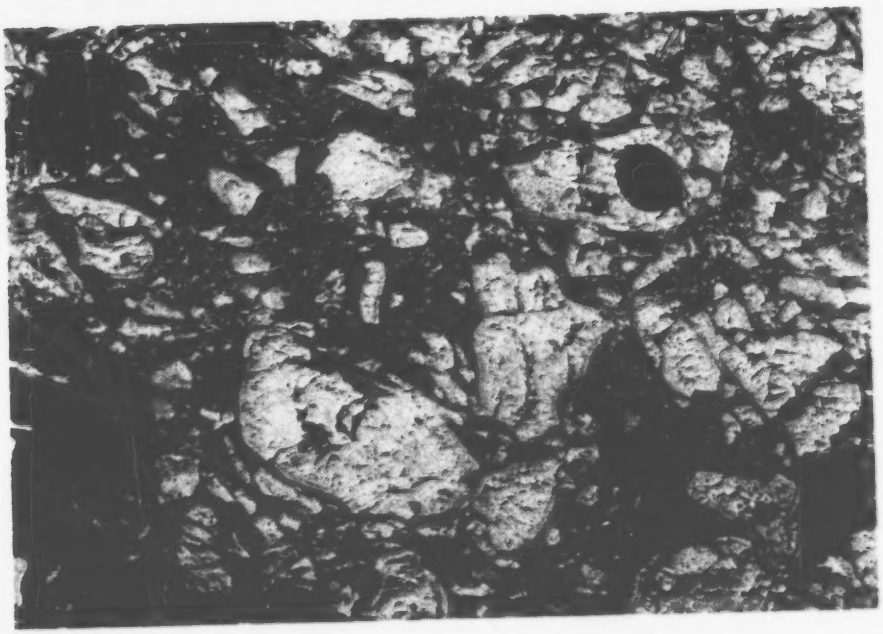

Photo 2 Flow-top breccia in metavolcanic rocks, Doon Township. Stratigraphic top is toward the upper left of the photo.

Photo 3 Banded chert-magnetite iron formation exposed on the eastern shore of Mistinikon Lake.

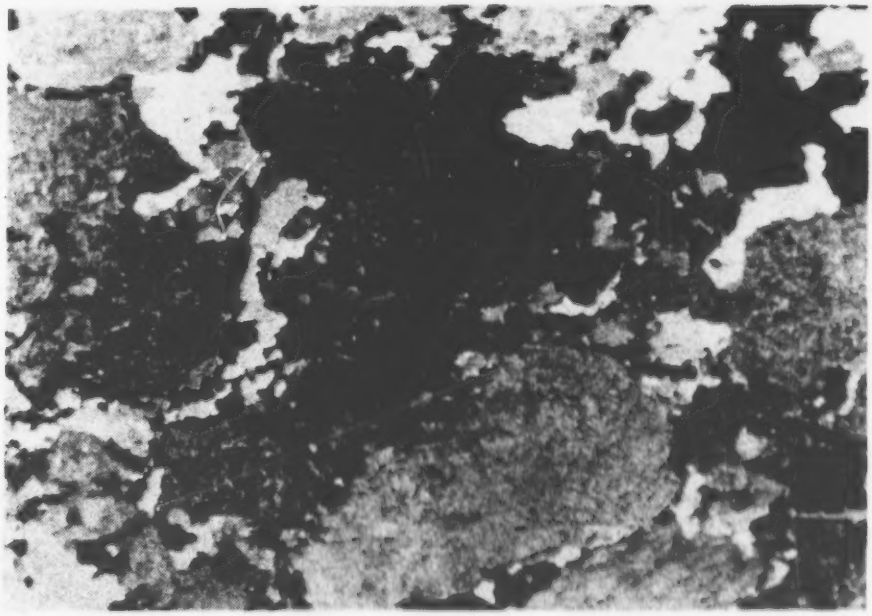

Photo 4 Photomicrograph of gneissic granodiorite. Note the large sericitized grains of plagioclase and the sutured texture of the quartz grains. The dark fibrous material in the centre of the photo is chlorite, altering from biotite. Field of view=4 mm. Crossed nicols.

Photo 5 Highly deformed gneissic granodiorite and mafic material exposed along the road which runs parallel to the logging road in Yarrow Township.

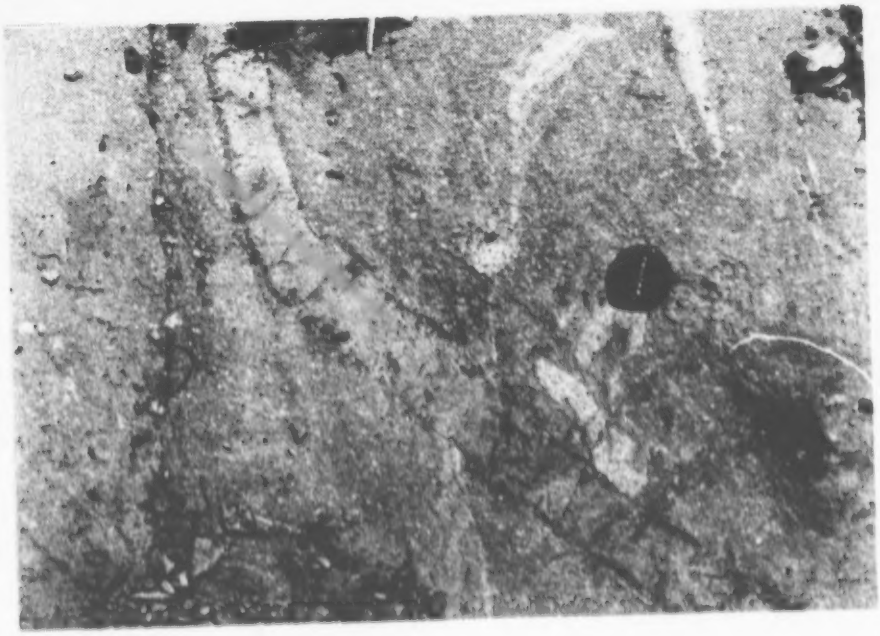

Photo 6 Porphyroclastic mylonite in a roadside exposure in south-western Yarrow Township. Note the rootless folds and the cross-cutting offshoot of a Matachewan diabase dike.

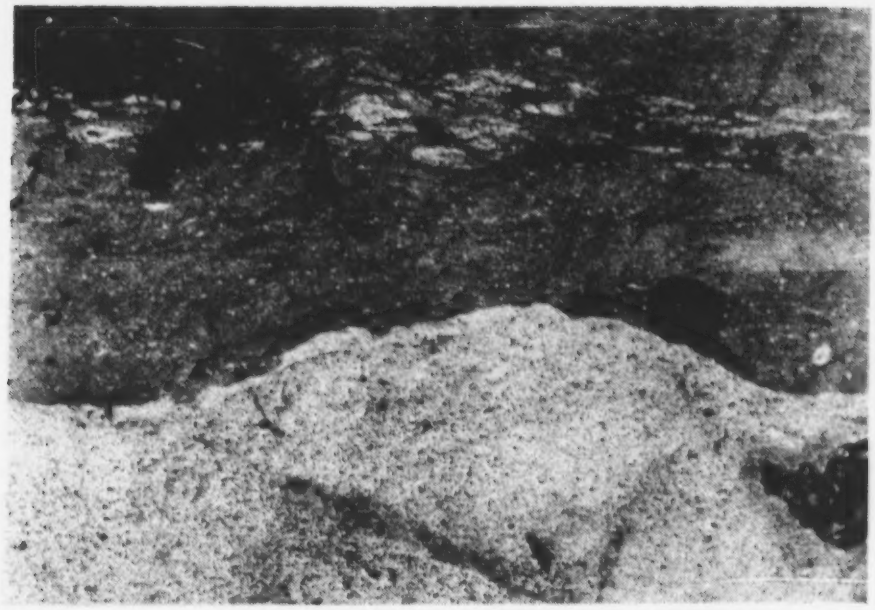

Photo 7 Hornblende-rich granodiorite intruding porphyroclastic mylonite. Roadside exposure, southwestern Yarrow Township.

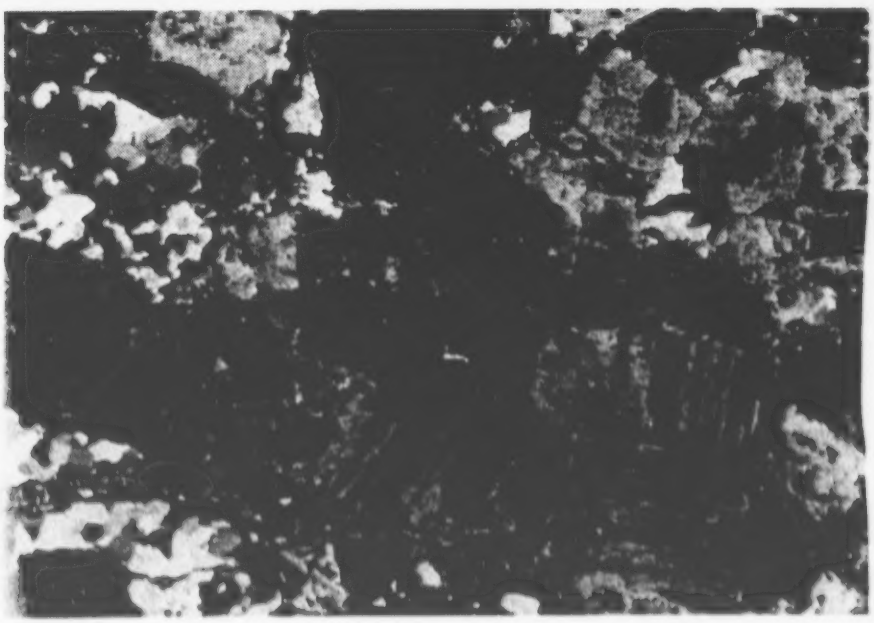

Photo 8 Photomicrograph of hornblende-rich granodiorite with microcline, quartz, and plagioclase. The dark mineral at the top centre is hornblende altered to a granular mass of epidote. Field of view=4 mm. Crossed nicols.

Photo 9 Photomicrograph of wacke clast (till pellet) in laminated siltstone-mudstone of the Gowganda Formation. Note the rounded form and closely packed angular to subrounded grains. Field of view = 4mm. Plane-polarized light.

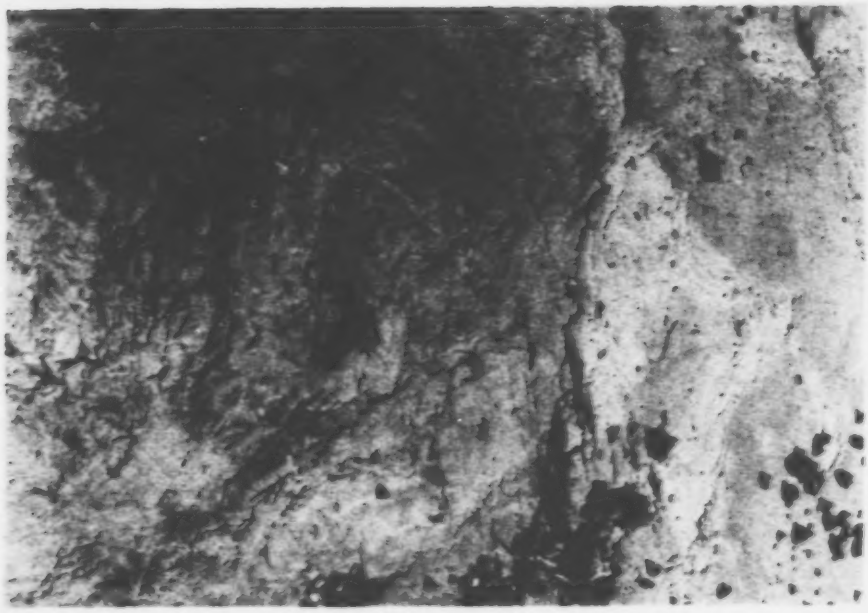

Photo 10 Laminated siltstone and mudstone from the Gowganda Formation. Dark grey laminae are siltstone; light grey laminae are mudstone.

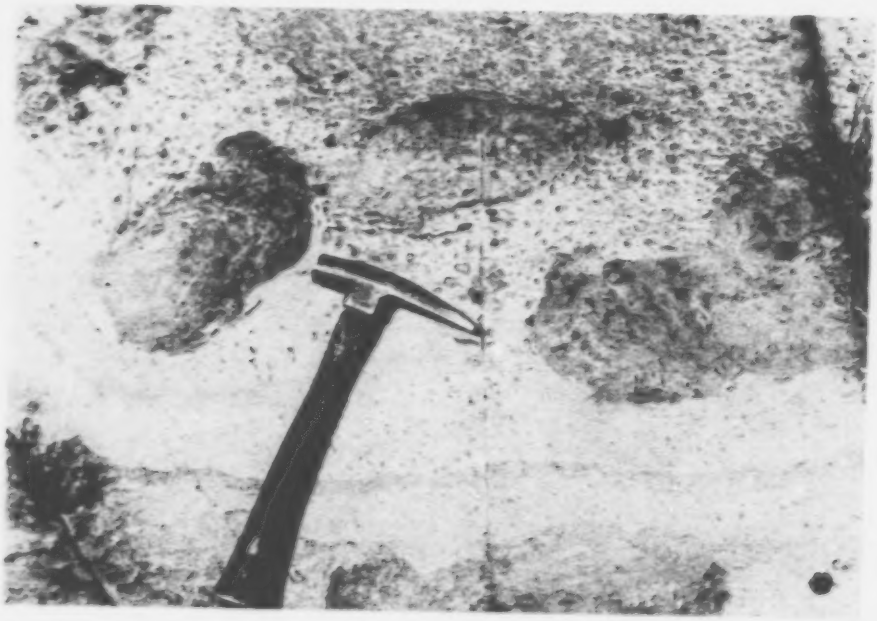

Photo 11 Ball and pillow structures from the Gowganda Formation. Note the sandstone balls which contain original laminae now deformed by slumping.

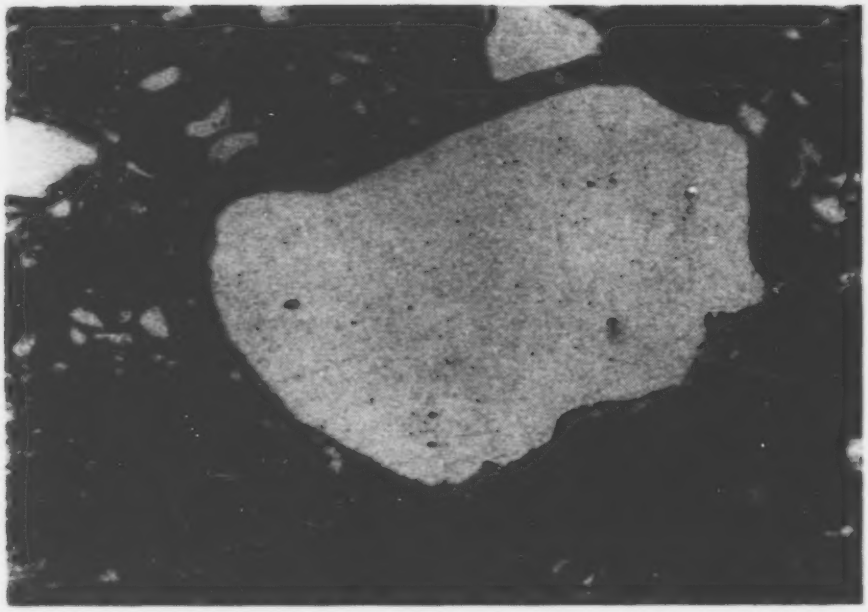

Photo 12 Photomicrograph of dropstone in laminated siltstone and mudstone from the Gowganda Formation. Note the deformed laminae below the clast and the small angular clasts of quartz and feldspar.

Photo 13 Granitic dropstone in laminated siltstone and mudstone from the Gowganda Formation. Note the deformed laminae below the clast and the draping of laminae over the clast.

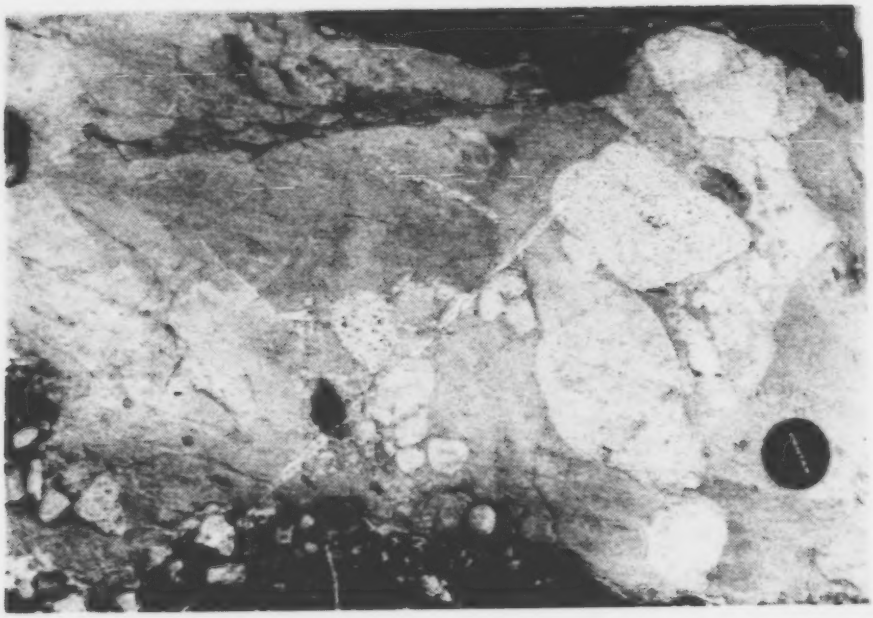

Photo 14 Lens of diamictite in sandstone from the Gowganda Formation. Note the close packing of clasts and the small pebble-filled injection structure above the centre of the photo.

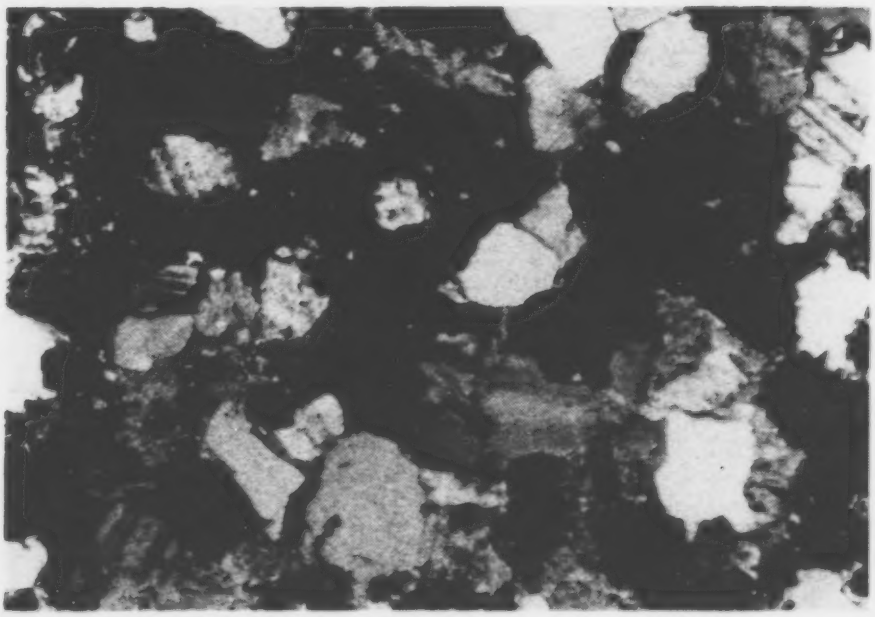

Photo 15 Photomicrograph of lithic arkose from the Gowganda Formation. Mineralogy - quartz, plagioclase feldspar, and lithic fragments with minor matrix.

Appendix

Geochemistry of Major Rock Types

The reconnaissance nature of the present work does not allow a detailed study of the geochemistry of the rock types of the area. In the following appendix several chemical analyses are listed for future evaluation.

Table 1: Metavolcanics

MAJOR OXIDE LISTING

	87RMJ-0009	87RMJ-0020	87RMJ-0021	87RMJ-0022	87RMJ-0023	87RMJ-0024	87RMJ-0030	87RMJ0022D	87RMJ0030D
Si02	51.40	67.80	48.40	57.80	47.80	56.50	70.70	58.10	70.50
Al203	10.30	14.50	15.00	13.90	94.10	12.30	14.90	13.90	14.90
Fe203	2.53	2.77	2.48	1.80	7.87	3.53	1.33	1.90	1.39
FeO	6.19	2.06	8.39	9.52	6.06	3.33	1.66	9.45	1.66
MgO	13.30	2.96	8.86	2.74	13.20	3.02	0.93	2.78	0.88
CaO	8.64	0.89	10.60	2.42	2.97	6.88	1.62	2.43	1.60
Na20	1.87	0.24	1.63	3.34	00.00	3.52	6.07	3.48	5.87
K20	1.13	3.31	0.07	0.48	0.02	1.33	0.67	0.47	0.66
Ti02	0.59	0.19	0.78	1.43	0.64	0.56	0.30	1.38	0.31
P205	0.26	0.05	0.03	0.13	0.04	0.06	0.05	0.12	0.04
MnO	0.16	0.09	0.18	0.18	0.22	0.09	0.05	0.18	0.05
C02	0.34	0.09	0.12	2.31	4.02	5.11	0.11	2.29	0.13
S	0.01	1.60	0.03	0.02	0.01	2.12	0.01	0.02	0.01
H20+	2.45	2.71	3.18	3.25	6.51	2.11	1.14	3.41	1.05
H20-	0.00	0.19	0.00	0.11	0.01	0.07	0.16	0.14	0.07
LOI	2.30	3.80	3.00	4.70	10.70	7.40	1.30	4.80	1.20
TOTAL	99.20	99.40	99.70	99.40	98.80	100.50	99.70	100.00	99.10
S.G.	2.93	2.78	3.03	2.70	2.51	2.77	2.68	2.70	2.60

TRACE ELEMENT LISTING

	METHOD	87RMJ-0009	87RMJ-0020	87RMJ-0021	87RMJ-0022	87RMJ-0023	87RMJ-0024	87RMJ-0030	87RMJ0022D	87RMJ0030D
Be	ICP/OES	-1	1	-1	-1	-1	1	-1	-1	-1
Co	ICP/OES	44	15	40	34	79	24	10	34	10
Cu	ICP/OES	28	166	60	59	187	42	6	61	5
Mo	ICP/OES	10	-10	10	10	-10	-10	-10	-10	10
Ni	ICP/OES	280	11	142	57	486	74	10	56	9
Sc	ICP/OES	30	3	29	24	33	13	4	29	4
Sr	ICP/OES	228	25	93	20	9	302	213	22	215
V	ICP/OES	181	16	253	288	177	121	38	284	36
Y	ICP/OES	14	-5	10	9	-5	5	-5	12	5
Zn	ICP/OES	81	116	65	114	70	60	30	118	50

CIPW-Norms

SAMPLE	87RMJ-0009	87RMJ-0020	87RMJ-0021	87RMJ-0022	87RMJ-0023	87RMJ-0024	87RMJ-0030	87RMJ0022D	87RMJ0030D
APTT	0.6390	0.1248	0.0737	0.3285	0.0548	0.1560	0.1205	0.3018	.6968
PYRT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ILMN	1.1627	0.3804	1.5364	2.8972	0.7029	1.1672	0.5797	2.7826	0.6016
ORTH	6.9290	20.6195	0.4290	3.0259	0.0683	8.6253	4.0285	2.9487	3.9854
ALBT	16.4194	2.1409	14.3047	30.1495	0.0000	32.6879	52.2616	31.2632	50.7565
ACMT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ANRT	16.9900	4.3102	34.6457	11.9013	8.3692	15.1814	7.8451	11.9665	7.8441
SPHN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
RUTL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MGNT	3.8064	4.2339	3.7293	2.7841	6.4989	5.6169	1.9621	2.9247	2.6574
HEMT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DIOP	16.7210	0.0000	10.7318	0.0000	0.0000	13.6371	0.0000	0.0000	0.0000
HEDN	3.7846	0.0000	5.2300	0.0000	0.0000	3.8587	0.0000	0.0000	0.0000

WOLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ENST	26.6198	7.7714	17.9087	7.2797	19.0116	1.9322	2.3567	7.3507	2.2396
FERS	6.9112	1.4210	10.0674	14.9007	2.3007	0.6271	1.5742	14.6930	1.5134
QRTZ	0.0329	49.4888	1.3135	22.6918	11.5576	16.5147	27.8876	22.0242	29.1527
FORS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FAYA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PVSK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NEPH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LEUC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DICA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KALP	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CNDM	0.0000	9.5131	0.0000	4.0508	51.3383	0.0000	1.3873	3.7537	1.7532
CALT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NPLG	50.8638	66.8138	70.7771	28.3022	100.0000	31.7142	13.0520	27.6812	13.3856
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FEMG	0.4100	0.0.882	0.3255	0.1855	0.2068	0.1025	0.0354	0.1846	0.0338
RMG	0.8360	0.8779	0.7004	0.3910	0.9157	0.8019	0.6630	0.3967	0.6604
RFE	0.1650	0.1221	0.2996	0.6090	0.0843	0.1981	0.3370	0.6033	0.3396
C.I.	59.0057	13.8066	49.2374	27.8618	28.6141	26.8394	6.4727	27.7511	6.4140
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TOTAL	100.0161	100.0039	100.0010	100.0096	100.0028	100.0047	100.0033	100.0090	100.0028
Northing	5304382	5304129	5261909	5302129	5304109	5306541	5305148	5302129	5305148
Easting	519726	518066	510668	506647	509656	519199	517958	506647	517958
Township	YARROW	YARROW	DOON	DOON	DOON	YARROW	YARROW	DOON	YARROW

Table 2: Granites

MAJOR OXIDE LISTING

	87RMJ-0001	87RMJ-0002	87RMJ-0003	87RMJ-0004	87RMJ-0005	87RMJ-0006	87RMJ-0007	87RMJ-0011	87RMJ0001D
Si02	66.00	55.60	70.90	67.60	74.70	64.70	73.00	68.70	65.80
Al203	15.80	15.40	14.60	16.40	14.10	16.60	14.90	16.00	15.80
Fe203	1.35	2.38	0.62	1.73	0.28	1.48	0.47	1.51	1.38
FeO	2.13	4.79	1.06	1.13	0.33	1.93	0.93	1.40	2.06
MgO	1.79	5.43	1.07	0.93	0.22	1.88	0.58	1.29	1.81
CaO	1.92	6.81	1.34	3.28	0.58	2.88	2.28	1.75	1.88
Na20	5.73	3.89	5.83	4.87	5.40	5.40	5.24	5.17	5.82
K20	2.87	1.47	2.17	1.41	2.70	1.68	0.98	1.63	2.84
Ti02	0.34	0.65	0.22	0.27	0.01	0.41	0.15	0.29	0.33
P205	0.16	0.34	0.08	0.09	0.01	0.17	0.04	0.10	0.15
MnO	0.07	0.13	0.03	0.05	0.02	0.06	0.02	0.09	0.07
C02	0.21	0.22	0.84	0.11	0.16	0.22	0.19	0.25	0.21
S	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
H20+	0.82	1.48	0.77	1.13	0.39	1.34	0.70	1.15	0.98
H20-	0.00	0.05	0.00	0.00	0.00	0.08	0.09	0.00	0.06
LOI	0.80	1.70	1.50	1.60	0.60	1.40	0.70	1.50	0.90
TOTAL	99.20	98.70	99.50	99.00	98.90	98.80	99.60	99.30	99.20
S.G.	2.68	2.84	2.61	2.72	2.57	2.71	2.66	2.68	2.68

TRACE ELEMENT LISTING

	METHOD	87RMJ-0001	87RMJ-0002	87RMJ-0003	87RMJ-0004	87RMJ-0005	87RMJ-0006	87RMJ-0007	87RMJ-0011	87RMJ0001D
Be	ICP/OES	1	1	-1	-1	-1	1	-1	-1	1
Co	ICP/OES	9	24	-5	6	-5	9	-5	7	8
Cu	ICP/OES	7	79	-5	20	-5	5	16	9	7
Mo	ICP/OES	-10	-10	-10	-10	-10	-10	-10	-10	-10
Ni	ICP/OES	19	74	7	6	-5	21	-5	7	18
So	ICP/OES	5	15	3	3	-2	6	2	4	5
Sr	ICP/OES	520	752	189	342	298	617	358	378	504
V	ICP/OES	58	172	22	32	7	66	13	38	58
Y	ICP/OES	7	13	-5	-5	-5	-5	-5	-5	6
Zn	ICP/OES	54	89	30	47	11	69	37	105	55

CIPW-Norms

	87RMJ-0001	87RMJ-0002	87RMJ-0003	87RMJ-0004	87RMJ-0005	87RMJ-0006	87RMJ-0007	87RMJ-0011	87RMJ-0001D
APTT	0.3861	0.8312	0.1935	0.2181	0.0241	0.4243	0.0961	0.2419	0.3628
PYRT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ILMN	0.6678	1.2741	0.4267	0.5245	0.0193	0.8012	0.2890	0.5624	0.6399
ORTH	17.2775	8.9655	13.0955	8.5230	16.2227	10.2146	5.8739	9.8357	17.1353
ALBT	49.3945	33.9726	50.3797	42.1528	46.4599	47.0144	44.9735	44.6718	50.2830
ACMT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ANRT	8.6388	20.8665	6.2552	16.0435	2.8592	13.5580	11.2078	8.1981	8.5223
SPHN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
RUTL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MGNT	1.9941	3.5615	0.9180	2.5658	0.4128	2.2079	0.6912	2.2356	2.0430

HEMT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DIOP	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEDN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WOLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ENST	4.5416	10.7983	2.7215	2.3693	0.5571	4.8175	1.4652	3.2807	4.6026
FERS	2.4091	4.7894	1.1507	0.2996	0.4020	1.8067	1.1248	1.0332	2.2748
QRTZ	14.5474	5.5109	24.4393	26.1691	31.7590	18.0754	33.0948	27.0997	14.0505
FORS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FAYA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PVSK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NEPH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LEUC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DICA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KALP	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CNDM	0.1625	0.0000	0.4245	1.1397	1.2848	1.0998	1.1861	2.8472	0.0947
CALC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NPLG	14.8859	38.0504	11.0448	27.5679	57974	22.3832	19.9493	15.5062	14.4923
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FEMG	0.0635	0.1859	0.0358	0.0259	0.0086	0.0617	0.0231	0.0405	0.0631
RMG	0.7124	0.7477	07566	0.9122	0.6455	0.7780	0.6312	0.8067	0.7267
RFE	0.2876	0.2523	0.2434	0.0878	0.3545	0.2220	0.3688	0.1933	0.2733
C.I.	9.6026	29.8731	5.2169	5.7592	1.3912	9.6333	3.5701	7.1120	9.5603
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TOTAL	100.0093	100.0198	100.0046	100.0054	100.0008	100.0098	100.0024	100.0064	100.0088
NORTHING	5306391	5304536	5298567	5298598	5299905	15299901	5299807	5298972	5306391
EASTING	520342	519622	524983	516295	519637	518432	518432	517666	520342
TOWNSHIP	YARROW	YARROW	YARROW	YARROW	YARROW	YARROW	YARROW	YARROW	YARROW

TABLE 3: MATACHEWAN DIABASE

MAJOR OXIDE LISTING

	87RMJ-0027
Si02	52.10
Al203	16.70
Fe203	3.21
FeO	7.19
MgO	3.85
CaO	6.97
Na20	4.14
K20	1.55
Ti02	1.26
P205	0.20
MnO	0.13
C02	0.22
S	0.06
H20+	1.51
H20-	0.00
LOI	1.50
Total	99.10
S.G.	2.91

TRACE ELEMENT LISTING

	METHOD	87RMJ-0027
Be	ICP/OES	2
Co	ICP/OES	38
Cu	ICP/OES	100
Mo	ICP/OES	10
Ni	ICP/OES	98
Sc	ICP/OES	12
Sr	ICP/OES	499
V	ICP/OES	183
Y	ICP/OES	14
Zn	ICP/OES	100

CIPW-Norms

	87RMJ-0027
APTT	0.4869
PYRT	0.0000
ILMN	2.4594
ORTH	9.4135
ALBT	36.0036
ACMT	0.0000
ANRT	0.0280
SPHN	0.0000
RUTL	0.0000
MGNT	4.7033
HEMT	0.0000

DIOP	5.1390
HEDN	4.0707
WOLL	0.0000
ENST	7.4721
FERS	6.7893
QRTZ	0.3664
FORS	0.0000
FAYA	0.0000
PVSK	0.0000
NEPH	0.0000
LEUC	0.0000
DICA	0.0000
KALP	0.0000
CNDM	0.0000
CALC	0.0000
NPLG	39.0096
	0.0000
FEMG	0.1660
RMG	0.5912
RFE	0.4088
C.I.	30.7139
	0.0000
	0.0000
	0.0000
TOTAL	100.0123
NORTHING	5299742
EASTING	517040
TOWNSHIP	YARROW

TABLE IV: GOWGANDA SANDSTONE

MAJOR OXIDE LISTING

SAMPLES	87RMJ-0012	87RMJ-0013	87RMJ-0014	87RMJ-0015	87RMJ-0016	87RMJ-0017	87RMJ-0001	87RMJ-0001
SiO2	73.20	71.30	80.50	60.80	62.60	65.50	61.50	81.30
Al2O3	11.40	13.70	11.00	16.40	17.20	15.50	16.90	10.40
Fe2O3	0.25	0.68	0.00	1.95	1.24	1.02	1.52	0.17
FeO	1.00	2.00	0.47	4.86	3.53	3.73	4.19	0.33
MgO	0.64	1.22	0.41	2.64	2.26	2.24	2.94	0.21
CaO	3.09	0.63	0.24	1.09	1.07	1.25	1.22	0.32
Na2O	5.23	4.07	5.85	3.75	5.27	4.36	3.65	5.57
K2O	1.55	3.97	0.08	3.34	3.45	2.90	3.41	0.08
TiO2	0.19	0.20	0.15	0.47	0.32	0.42	0.50	0.09
P2O5	0.04	0.05	0.03	0.12	0.13	0.14	0.14	0.02
MnO	0.05	0.04	0.01	0.07	0.07	0.07	0.07	0.01
CO2	2.51	0.28	0.13	0.12	0.08	0.09	0.08	0.22
S	0.07	0.05	0.02	0.04	0.05	0.08	0.06	0.04
H2O+	0.55	1.00	0.37	2.69	1.33	1.70	2.29	0.28
H2O-	0.00	0.06	0.05	0.10	0.00	0.00	0.11	0.00
LOI	2.30	1.20	0.40	2.40	1.70	1.40	2.50	0.40
Total	99.80	99.30	99.30	98.50	98.60	99.00	98.50	99.00
S.G.	2.64	2.64	2.63	2.74	2.67	2.70	2.72	2.61

	METHOD	87RMJ-0012	87RMJ-0013	87RMJ-0014	87RMJ-0015	87RMJ-0016	87RMJ-0017	87RMJ-0018	87RMJ-0019
Be	ICP/OES	-1	1	-1	2	2	2	2	-1
Co	ICP/OES	5	7	-5	19	14	16	16	-5
Cu	ICP/OES	44	200	5	11	10	49	40	74
Mo	ICP/OES	-10	-10	-10	-10	-10	-10	-10	-10
Ni	ICP/OES	10	24	-5	61	46	50	55	-5
Sc	ICP/OES	6	5	2	8	7	9	8	2
Sr	ICP/OES	106	131	35	161	712	221	199	31
V	ICP/OES	26	49	12	105	72	84	94	13
Y	ICP/OES	11	5	7	8	6	8	8	-5
Zn	ICP/OES	10	26	7	62	66	69	65	5

CIPW-Norms

SAMPLE	87RMJ-0012	87RMJ-0013	87RMJ-0014	87RMJ-0015	87RMJ-0016	87RMJ-0017	87RMJ-0018	87RMJ-0019
APTT	0.0980	0.1210	0.0720	0.2977	0.3170	0.3414	0.3453	0.0481
PYRT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ILMN	0.3734	0.3881	0.2885	0.9348	0.6256	0.8212	0.9888	0.1735
ORTH	9.4778	23.9728	0.4788	20.6691	20.9872	17.6432	10.9815	0.4799
ALBT	45.7935	35.1923	50.1327	33.2301	45.9062	37.9832	32.1588	47.8495
ACMT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ANRT	3.1581	2.8600	1.0073	4.8419	4.5902	5.4428	5.3496	1.4790
SPHN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
RUTL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MGNT	0.3751	1.0075	0.0000	2.9608	1.8508	1.5226	2.2947	0.2502

HEMT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DIOP	3.5577	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEDN	2.7418	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WOLL	1.9995	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ENST	0.0000	3.1049	1.0341	6.8855	5.7943	5.7436	7.6240	0.5310
FERS	0.0000	2.9174	0.6421	6.9824	5.2084	5.6042	5.9797	0.3406
QRTZ	32.4279	28.7205	45.4093	18.0513	11.4728	21.5589	18.7450	48.2235
FORS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FAYA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PVSK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NEPH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LEUC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DICA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KALP	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CNDM	0.0000	1.7186	0.9369	5.1538	3.2552	3.3472	5.5411	0.6257
CALC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NPLG	6.4515	7.5159	1.9698	12.7177	9.0902	12.5335	14.2624	2.9983
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FEMG	0.0275	0.0530	0.0152	0.1215	0.0972	0.0997	0.1213	0.0079
RMG	0.5978	0.5831	0.6791	0.5644	0.5938	0.5739	0.6262	0.6720
RFE	0.4022	0.4169	0.3209	0.4356	0.4062	0.4261	0.3738	0.3290
C.I.	7.0480	7.4179	1.9647	17.7635	13.4792	13.6917	16.8072	1.2954
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TOTAL	100.0028	100.0032	100.0017	100.0074	100.0078	100.0084	100.0085	100.0012
NORTHING	5304837	5304211	5299888	5304204	5304514	5301584	5300413	5305611
EASTING	517336	513808	513357	510694	511212	513129	513755	517957
TOWNSHIP	YARROW	DOON	DOON	DOON	DOON	DOON	DOON	YARROW

TABLE V: Nipissing Diabase

MAJOR OXIDE LISTING

	87RMJ-0025	87RMJ-0026	87RMJ-0028
Si02	50.80	50.80	45.60
Al203	16.00	14.20	12.50
Fe203	2.02	3.40	6.50
FeO	6.79	9.52	12.10
MgO	7.54	5.58	4.19
CaO	9.17	8.10	10.00
Na20	1.42	2.45	2.45
K20	2.58	1.80	0.12
Ti02	0.51	1.13	2.54
P205	0.02	0.13	0.16
MnO	0.17	0.22	0.26
C02	0.75	0.18	0.43
S	0.08	0.11	0.01
H20+	1.83	1.99	2.75
H20-	0.05	0.22	0.19
LOI	2.70	1.70	2.50
Total	99.70	99.80	99.80
S.G.	2.97	3.02	3.12

TRACE ELEMENT LISTING

	METHOD	87RMJ-0025	87RMJ-0026	87RMJ-0028
Be	ICP/OES	-1	1	2
Co	ICP/OES	36	41	41
Cu	ICP/OES	129	136	29
Mo	ICP/OES	-10	-10	10
Ni	ICP/OES	105	75	14
Sc	ICP/OES	26	33	37
Sr	ICP/OES	62	225	83
V	ICP/OES	102	298	187
Y	ICP/OES	8	24	29
Zn	ICP/OES	66	106	118

CIPW-Norms

SAMPLE	87RMJ-0025	87RMJ-0026	87RMJ-0028
APTT	0.0488	0.3164	0.3930
PYRT	0.0000	0.0000	0.0000
ILMN	0.9984	2.2050	5.0031
ORTH	15.7142	10.0285	0.7354
ALBT	12.3847	21.2999	21.5010
ACMT	0.0000	0.0000	0.0000
ANRT	30.5750	23.0479	23.6003
SPHN	0.0000	0.0000	0.0000

RUTL	0.0000	0.0000	0.0000
MGNT	3.0188	5.0649	9.7743
HEMT	0.0000	0.0000	0.0000
DIOP	8.8925	7.8424	10.6409
HEDN	4.2413	6.5018	11.6797
WOLL	0.0000	0.0000	0.0000
ENST	15.2328	10.6426	5.8897
FERS	8.3338	10.1209	7.4154
QRTZ	0.5631	2.0395	3.3791
FORS	0.0000	0.0000	0.0000
FAYA	0.0000	0.0000	0.0000
PVSK	0.0000	0.0000	0.0000
NEPH	0.0000	0.0000	0.0000
LEUC	0.0000	0.0000	0.0000
DICA	0.0000	0.0000	0.0000
KALF	0.0000	0.0000	0.0000
CNDM	0.0000	0.0000	0.0000
CALC	0.0000	0.0000	0.0000
NPLG	71.1713	51.9708	52.3274
	0.0000	0.0000	0.0000
FEMG	0.2731	0.2451	0.2111
RMG	0.7061	0.5802	0.5107
RFE	0.2939	0.4198	0.4893
C.I.	40.7174	42.3776	50.4031
	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000
TOTAL	100.0033	100.0098	100.0120
NORTHING	5288837	5306234	5302593
EASTING	523970	519616	507789
TOWNSHIP	YARROW	YARROW	DOON

TABLE VI: MYLONITES

MAJOR OXIDE LISTING

	87RMJ-0008	87RMJ-0010
Si02	60.20	53.90
Al203	15.30	18.70
Fe203	1.54	2.19
FeO	5.06	5.86
MgO	4.68	4.39
CaO	1.06	1.71
Na20	4.34	3.84
K20	1.70	4.03
Ti02	0.53	0.84
P205	0.19	0.28
MnO	0.11	0.12
C02	0.14	0.39
S	0.01	0.09
H20+	2.93	3.38
H20-	0.22	0.00
LOI	2.90	3.30
Total	98.80	99.60
S.G.	2.70	2.74

TRACE ELEMENT LISTING

	METHOD	87RMJ-0008	87RMJ-0010
Be	ICP/OES	2	3
Co	ICP/OES	24	27
Cu	ICP/OES	7	16
Mo	ICP/OES	-10	10
Ni	ICP/OES	172	89
Sc	ICP/OES	11	15
Sr	ICP/OES	220	203
V	ICP/OES	103	142
Y	ICP/OES	5	17
Zn	ICP/OES	142	120

CIPW-Norms

SAMPLE	87RMJ-0008	87RMJ-0010
APTT	0.4712	0.6918
PYRT	0.0000	0.0000
ILMN	1.0539	1.6642
ORTH	10.5180	24.8429
ALBT	38.4503	33.8963
ACMT	0.0000	0.0000
ANRT	8.3616	6.9414
SPHN	0.0000	0.0000
RUTL	0.0000	0.0000
MGNT	2.3378	3.3124
HEMT	0.0000	0.0000

DIOP	0.0000	0.0000
HEDN	0.0000	0.0000
WOLL	0.0000	0.0000
ENST	12.2036	11.4056
FERS	7.6943	8.1239
QRTZ	15.3681	3.3148
FORS	0.0000	0.0000
FAYA	0.0000	0.0000
PVSK	0.0000	0.0000
NEPH	0.0000	0.0000
LEUC	0.0000	0.0000
DICA	0.0000	0.0000
KALP	0.0000	0.0000
CNDM	3.5530	5.8234
CALC	0.0000	0.0000
NPLG	17.86.21	16.9975
	0.0000	0.0000
FEMG	0.1799	0.1752
RMG	0.6758	0.6485
RFE	0.3242	0.3515
C.I.	23.2896	24.5061
	0.0000	0.0000
	0.0000	0.0000
	0.0000	0.0000
TOTAL	100.0117	100.0167
NORTHING	5300053	5303609
EASTING	517870	519355
TOWNSHIP	YARROW	YARROW

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